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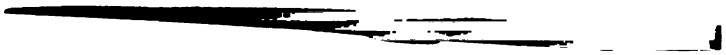

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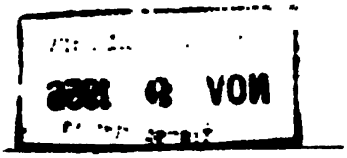

VOL. IV.

"Genius is neither above law nor opposed to it; but, provided only that the law to which it is proposed to subject it be one worthy of its obedience, finds its best strength, as well as its most appropriate embellishment, in wearing its fetters. Art, which is the manifestation of genius, is equally the manifestation of judgment; which, instead therefore of being something irreconcilable with genius, may from this truth be discerned to be, not only its most natural ally, but in all its highest creations its indispensable associate and fellow laborer."—PURSUIT OF KNOWLEDGE UNDER DIFFICULTIES.

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PREFACE.

Custom renders it necessary, and gratification, for the continued support given to this publication, renders it a pleasing duty, to particularly address our readers at the close of each volume, to offer our thanks for past favors, and to solicit a continuance of their patronage and influence in supporting a work which has been pronounced by competent judges to be worthy of a most extensive circulation.

The human mind naturally feels dissatisfied under the confines of ignorance, and a strong impulse has been given to increase that dissatisfaction, by the wide circulation, in a cheap form, during the last few years, of works of value and importance, calculated to render the ardent desirer to acquire information still more ardent, and arouse the indolent to seek by observation and experiment that practical knowledge which they have hitherto been contented to be acquainted with only in theory. It has been, and ever will be, our aim to add to this spirit of inquiry—to endeavor to awaken the dormant energies of some of our most practical mechanics, and to prevail upon them to give those notions of improvement and inventions to the public, which they, from the nature of their daily avocations, have so frequent opportunities of observing. Our attempt, we think, has not been in vain. On reference to the volumes already published, we hesitate not to say, that they contain more useful suggestions and plans, from original thinkers, than any work of a similar size and price that has ever been issued from the press in the United States.

It has been asserted frequently, that it is impracticable to unite the pursuits of literature and science with those of commercial and agricultural pursuits; and the advocates of such a doctrine have advanced as an argument, that the time necessarily employed in their daily avocations, and the care that devolves upon them by attending to their families, must engross the whole of their attention. Such an absurd doctrine is easily refuted by reference to the biographies of some of the most distinguished men that ever lived. Benjamin Franklin, while engaged in the arduous duties of a journeyman printer, found time so to enrich his store of knowledge, that we trace in his after history "the fame of the patriot vying with that of the philosopher in casting a splendor over it; and the originally poor and unknown tradesman standing before kings, associating as an equal with the most eminent statesmen of his time, and arranging along with them the wars and treaties of mighty nations."

Roger Sherman, a self-educated man, will long live in the memory of his countrymen, for the active part he took in preparing that Declaration of Independence which was adopted, and the doctrines of which were enforced, by a band of patriots who "pledged their lives, their fortunes, and their sacred honor," to carry it into effect. The immortal Shakspeare, by his application and perseverance, advanced himself from the menial situation of an ostler to, first, an actor, and afterwards a theatrical proprietor.

Robert Burns, one of the most distinguished poets of his time, was for many years a plough-boy, and subsequently employed in other capacities as an agricultural laborer. Numerous other instances might be quoted, but we think these will be sufficient to induce all who wish to promote the arts and sciences, and to bring forth some of that latent talent which so abounds in this country, to assist us in endeavoring to gain a more extended circulation to this work, which professes to advocate the diffusion of useful knowledge, and in which we endeavor to bring before the notice of our readers all that can be gleaned that is valuable from the publications of the Old and the New World.

With such aid we should indeed go on rejoicing; it would inspire us with increased energy, and we should be sanguine enough to hope that, although at present

"Around its breast the rolling clouds are spread,

the time is not far distant when it will be known, and felt, and acknowledged, that

"Eternal sunshine settles on its head."

New-York, December, 1834.

INDEX.

A.

Agriculture in Scotland, 112
Age of the World, 102
American Institute, Address before, at Chatham st. Chapel, by Hon. Henry Baldwin, of Philadelphia, 308 to 320—Seventh Annual Report of, 241—Supplemental Report, 297
American Journal of Science, Review of, 240
Americans, mixed blood of, favorable to the promotion of literature and science, 46
Animal Mechanics, proofs of design in the formation of the human frame, 41, 113 to 116, 150, 225, 228, 278.
Animal power in Great Britain, 359
Apparatus for raising vessels, to repair them, by R. Porter, 98—for extracting caloric, by compression, for heating rooms, by Rufus Porter, 141—for removing stone from the bladder, 202—for analysing marl, 246
Arauca, on the ruins of, 284
Archimedes, in reply to C. Harris, on twin boats, 116
Architecture, compendium of, continued from p. 324, vol. 2, 17 to 24, 67, 166 to 176, 194 to 198, 275, 325
Astronomy, history of, continued from page 293, vol. 3, 9, 98 to 101, 161 to 164, 217 to 220, 261 to 266, 337
Astor's (or the Park) hotel, foundation stone of, laid, with inscription, 48
Atmospheric pressure, 76
Atmospheric pressure on the animal economy—premium for a prize essay offered, 297

B.

Balance, on the application of the principle of, 237
Baldwin, Hon. Henry, his address before the American Institute, 308 to 320.
Balloon, with steam power attached, 142—for an observatory, by Rufus Porter, 215—for travelling with passengers, by Rufus Porter, 273, 289
Barometer, improved, described by C. Durant, 210
Bees, observations on Mr. Nutt's book respecting, 233 to 237
Bee-hive, improved, account of, 16
Bible for the blind, 208
Blacksmiths, new invented machine for saving their labor, 32
Boat used in the Friendly Islands in 1793, on the same plan as Burden's, 49—easiest method of propelling, 341
Boats, twin, for canal navigation, 117
Brewing, on the art of, as practised in various countries, 1
Brick making machine, account of, 26
Burden's boat, its first trip to Albany and Troy, account of, 51—controversy respecting, between Archimedes and C. Harris, 51—Archimedes' further reply, 116

C.

Camp's double flue cooking stove described, 328
Camphor, exposed for sale in the open air in India, 45
Canals, Chesapeake and Ohio, statistics of, 27 to 31, and 191—in Burgundy, for uniting the Rhine with the Rhone, 272—on the probable location of, 127
Canning's dispatch raft described, 50
Centre of gravity, illustrated by the actions and postures of animals, and especially man, 148
Christian religion, on the value of, 45
Chariot, sailing, described, 81
Chimneys that will not smoke, method of building, 324
Chinese ignorance, 93
Chinese historical record, 104
Cholera, Asiatic, remedy for, 112
Christian Library, review of, 252
Churning, on the application of the principle of a balance to, 239
Churning machine, Pratt's new, 263
Civil engineers, proposals for establishing a society of, America, 271
Cider mill and press, Beecher's portable, 216
Cloth made from old rags, 221
Coal mines, their produce in England, 46
Collar Block, patent, described, 368
Comet, new, 119—on the length of life in, 307
Compass needle, Smith's report of, 341
Corn shelling machine, account of, 77
Consumption, pulmonary, among American Indians, 297
Copper in vegetables, calculation of the quantity, 293
Cordage, on the strength of, 77
Corrosive sublimate and calomel, new analysis of, by Dr. Turner, 72

D.

Davy, Sir H., on the application to the arts, resulting from his electro-chemical theory, 130
Damascus steel, 76
Draining, method of, by a farmer, 9
Dry Rot, proposed remedies for, 118, 232, 361
Dugdale's wind mill, report of, 340
Durant's improved barometer described, 210

E.

Earth excavating machine, account of, 26
Education, beneficial results from, in various countries, 14
Emigrants, hints to, on clearing of land, 105
Employment of time, 360
Enamelling cast iron hollow ware, with porcelain, account of, 35
Ewbank's hydrostatic safety valve, 24
Ewbank's leaden pipes, safety of his plan of lining with tin, 171
Eyes, weak, how to cure, 359

F.

Feather beds, evils of, 359
Fevers, on the cause of, 45
Feuchtwanger, Dr., review of his catalogue of drugs, 132
Filters, on the employment of, in chemical analysis, by Dr. Turner, 37
Fishes, account of naturalization of, 32
Flagg's shingle machine, account of, 95
Flame, on the phenomena of, by J. O. Rutter, 55 to 60
Food, experiments respecting, 270
Fossil horns discovered in digging the canal at Lancaster, (England,) account of, 16
Franklin Institute, their report respecting weights and measures, 118 to 126
Fulling, on the application of the principle of the balance to, 239
Fulton, Robert, memoir of, 260 to 276

G.

Geological surveys, 224
Gigs, sheet iron, in Scotland, account of, 16
Glass tiles, invented by Mr. Dorlat, 96
Gold mines in Virginia, account of, 32—their produce in the New World compared with the coal mines of England, 46
Grafting, on, by Professor Rennie, 345
Gun lock, percussion, improved, described, 250

H.

Harris' steam boat, letter respecting, 51
Hame collar block, Posts' described, 240
Heavens, appearance of, at the rising and setting of the sun, 97
Hearing, mechanism of, 328
Heart, circulation of the blood through, proof of design in the formation of the animal frame, 41, 113 to 116, 150, to 154
Heat, improved process for generating, applicable to boilers, by J. O. Rutter, 31—of comets, 76—in Philadelphia, during the last ten years, 192, 359
Henderson's chart of commercial weights, 342
Herschel's reflecting telescopes, described, 26

Hot water apparatus, described, 187
Hydrostatic Press, on the application of the principle of the balance to, 239

I.

Industry and perseverance, 109
Intercourse with the world, 144
Invalids, bedstead for, invented by Mr. Woolley, 74
Ink, sympathetic, receipt for making,
India rubber for ropes, proposed by Dr. Mackie, 305
Iron Wheels, 16
Iron hollow ware lined with porcelain, account of, 35
Iron boat on a new principle, 208
Ireland, manufactures in, 207

K.

Knowledge, on the diffusion of, 112—thirst for, 118

L.

Language, attempt to account for the variety of, 101
Land measuring, machine for, by James Chesterman, described, 107
Lead mines in Missouri, 128
Legends of ecclesiastical history, 103
Light, immense number of particles that flow from the blaze of a candle, 34
Life's Likeness, poetry, 304
Life, on the tenacity of, 307
Locomotive engine, new, account of, 111
Locke, John, on the piety of, 223
Lyceum of natural history in New-York, proceedings of, 285 to 288

M.

Machine for excavating the earth, 26—for making bricks, 26—for land-measuring, described, 107
Machinery to measure time, 221
Mahomedan months, account of, 296
Manufacturing establishments in Cincinnati, 350—in Pittsburgh, 351
Mathematical science, on the comparative value and importance of, by G. B. Cheverton, 183, 198 to 201, 259, 260
M'Adam, jun., on railroads in Virginia, 255
Mechanist, self taught, in Scotland, 106
Mechanics' Institute in New-York, letter respecting, and remarks upon, 180
Mechanic of talent in his proper station, 213
Mechanics' convention at Utica, for considering the effect of state prison labor, report of, 133 to 140
Meteorological record, kept at Avoyelle Ferry, for May and June, 1834, 96
Meteorological stone in Finland, answering the purpose of a barometer for the public, 64
Mexico, account of a visit to, 252 to 255
Minor's railroad map, review of, 131
Microscopic view of a drop of water, 65
Milking, on the application of the principle of a balance to, 233
Moral principles, the safeguard of liberty, 14

N.

Natural history, on the study of, in common schools, 266
Needle, on the dip and declination of the, 16
Newton, Sir Isaac, on the piety of, 223
Nutt's book on bees, observations upon, 237

O.

Ocean, on the depth of, 40
Ohio river, tunnel under, proposed, 189
Oil, palm, method of purifying, 203
Ore, silver, in the Oural mountains, 171
Ostrich, on the swiftness of, 220
Ox mill, used in Vienna for brewing purposes, 1
Oven, Gold's portable, described, 243
Oyster lamp, account of, 360

P.

Papoose, petrified, account of a, 15
Peck's method of propelling boats, 340
Phrenology, account of the external manifestations of the organs, 39—review of Dean's lectures on, 94
Philosophical facts, 108
Periodical publications, on the transportation of, 201
Planaria, result of Dr. Johnson's experiments respecting, 144
Poetry, On the existence of a God, 32
Porter Rufus, his plan for raising vessels for repairing, 92—his method of sheathing bottoms of vessels, 118—his apparatus for extracting caloric by compression for heating rooms—on the arrangement of cylindric steam boilers, 178—his scale of signals for an improved telegraph, described, 193—his plan for a balloon to use as an observatory, 216—his independent pump, described, 257—his plan for a balloon to carry passengers, account of, 273 and 299
Printing, on the application of the principle of a balance to, 240
Pumping, on the application of the principle of a balance to, 238
Pump, Porter's independent, described, 257

Q.

Quietude, benefits of, 32

R.

Railroad, to Darien, 8—on the probable location of, in the United States, 127—on the construction of, 159—from New-York to Washington, through Philadelphia and Baltimore, 190—from Amsterdam to Cologne 224—Liverpool and Manchester, 224—in Virginia, 255
Railroad curvatures, by S. Vandegraff, 171 to 175, 203 to 206, 332 to 336
Railways, undulating, 5, 343
Review of Dean's lectures on phrenology, 94—Minor's Railroad Map, 131—Dr. Feuchtwanger's catalogue of drugs, 132—Dr. Yates on cholera, 132—New-York Literary Gazette, 208—of the principles and practice of carpentry, 294—Christian Library, 352
Rockwell's patent vault lights, 92
Rocks, on the blasting of, 360
Rotary engine, non-reciprocating, 129
Road, for locomotive engines, how to construct, 100
Ruling machine, (Petival's,) 17
Rutter, on the phenomena of flame, 55 to 60
Rutter's improved plan for generating heat in boilers and retorts, 27

S.

Sails, revolving, proposed plan of, by Mr. Willis, 307
Sailing, against the wind, method of, 63, 116
Safety valve, for steam boilers, plan of fixing, by David S. Lee, 80
Sand in Pekin, 104
Sash lines, patent, 363
Science, on the love of, 284
Science and Theology, connexion between, 295
Sea sledge, description of, 38
Self-education, example of, in Mr. Ewing, 15
Schools in Liberia, 270
Ships, method of sheathing the bottoms of, by Rufus Porter, 118
Silk manufacture, from the cultivation of the mulberry in the United States, urged, 47
Silver mines in Barnsoule, 352
Sister's love, 352
Shingle machine, Flagg's improved, described, 95
Smith's compass needle, report of, 340
Spiders, number of different species, 104, 269
Spontaneous combustion, 104, 269
State prison labor, report of Mechanics' Convention at Utica, respecting, 133 to 140—remarks upon, 145—further remarks and letters, 289 to 293
Steam car, proposed, attached to a balloon, 142
Steam carriages on common roads, success of, 53, 354 to 357, 358, 359—Russell's, described, 167, 168—in France, 221—Stephenson's, 223
Steam, Boilers, cylindric, by Rufus Porter, 179
Steam engine, the cotton spinner's best friend, 61
Steam applied to agricultural purposes, 77
Steam navigation, between Calcutta and England, 7—in India, 207—by the Red Sea, 49—remarks on the rival claims to its introduction, 164
Steam fund committee in Bengal, operations of, 224
Steamboat travelling in the West, 13—aerial one, 53—in America, 271—on the Western waters, 349
Stephenson's improved locomotive engine, 223
Stirrup, description of a new patent safety, 285
Stomach, its functions described, proofs of design in the formation of the animal frame, 228
Structure of the human frame, proofs of design in the formation of, 279
Stoves, Fessenden's new ones, 108—Doric one described, 17—Naylor's hot air and self-ventilating, 248—Naylor's coal cooking, 244—Graham's, 245—Camp's, 328
Sugar refining in France, 256
Symington's lifting machine, account of, 354

T.

Telescopes, large reflecting, (Dr. Herschel's,) 36
Telegraph, Porter's improved signals, 193
Telegraphic science, 270
Theatres, new method of lighting, 208
Tides, proposed survey of, 294
Tunnel, under the Ohio river, proposed, 189
Turner, Dr., on the employment of filters in chemical analysis, 37—his new analysis of corrosive sublimate and calomel, 72

U.

Undulating railways, 5

V.

Valve, Ewbank's hydrostatic safety,

described, 24—Lees' patent, for fixing, 80
Vicissitudes of life, 196
Virginia gold mines, account of, 33

W.

Walls of Mud, 360
Washington, George, letter of his never before printed, 63
Water, drop of, as seen through a microscope, 65
Wasp, ingenuity of, 93
Wasp, sting of, how to cure, 359
Washing machine, improved, 192
Waggons, as packets, proposed plan for making them more useful as public conveyances, 175
Weather, influence of the moon upon, 305
Weights and measures, report of the Franklin Institute respecting, 119 to 126
Wheels, iron, account of, 16
Wheel, Oryffreus' described, 39
Wheels with straight and with curved arms, description of, 73—for railroad cars, 111
What o'clock is it? 160
Wine making, art of, by Mr. Booth, 154
Wind mill, 240
Wind-pipe, construction of, proof of design in the formation of the animal frame, 225
Working classes, on the means of elevating the character of, 82 to 90
Worms in the blood, 342

Y.

Yates, Dr., on cholera, review of, 132

Z.

Zincography—a new invention, connected with the fine arts, 369

MECHANICS' MAGAZINE,

AND

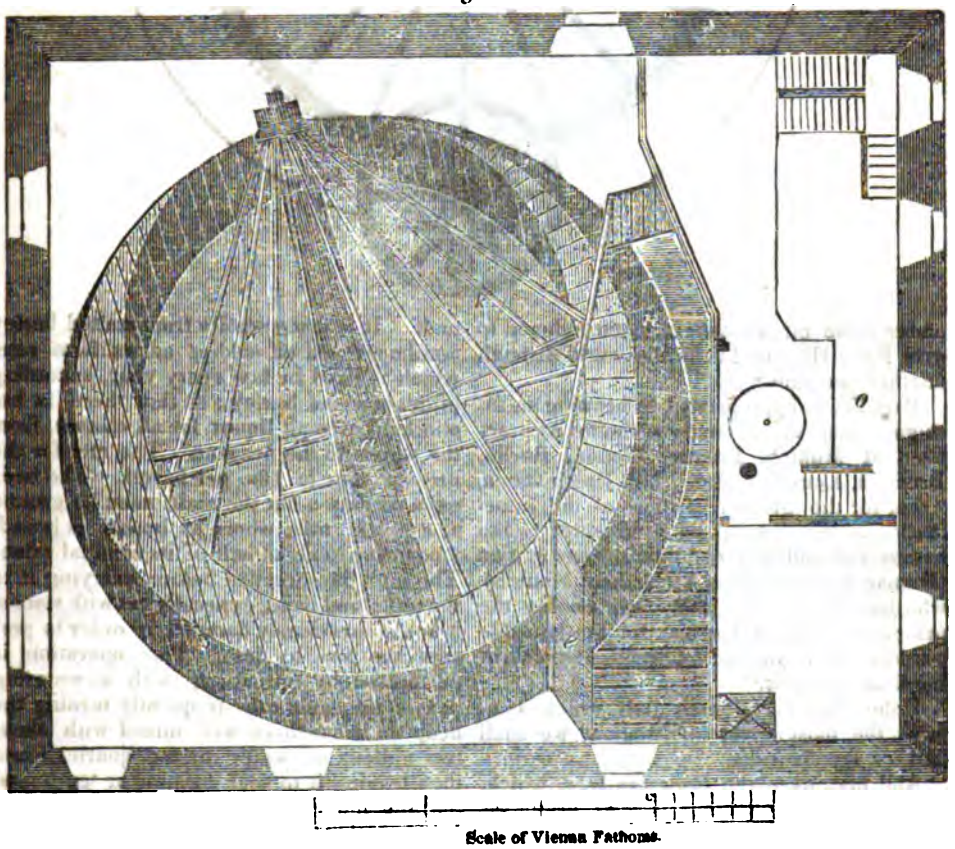
REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] JULY, 1834. [NUMBER 1.

"The man whose mind is irradiated with the light of substantial science, perceives the atmosphere as the agent under the Almighty which produces the germination and growth of plants, and all the beauties of the vegetable creation—which preserves water in a liquid state, supports fire and flame, and produces animal heat—which sustains the clouds, and gives buoyancy to the feathered tribes—which is the cause of winds—the vehicle of smells—the medium of sounds—the source of all the pleasures we derive from the harmonies of music—the cause of that universal light and splendor which is diffused around us, and of the advantages we derive from the morning and evening twilight. In short, he contemplates it as the prime mover in a variety of machines—as impelling ships across the ocean, blowing our furnaces, grinding our corn, raising water from the deepest pits, extinguishing fires, setting power looms in motion, propelling steamboats along rivers and canals, raising balloons to the region of the clouds, and performing a thousand other beneficent agencies, without which our globe would cease to be a habitable world."—DR. DICK.

AUSTRIAN OX-MILL.

Fig. 1.

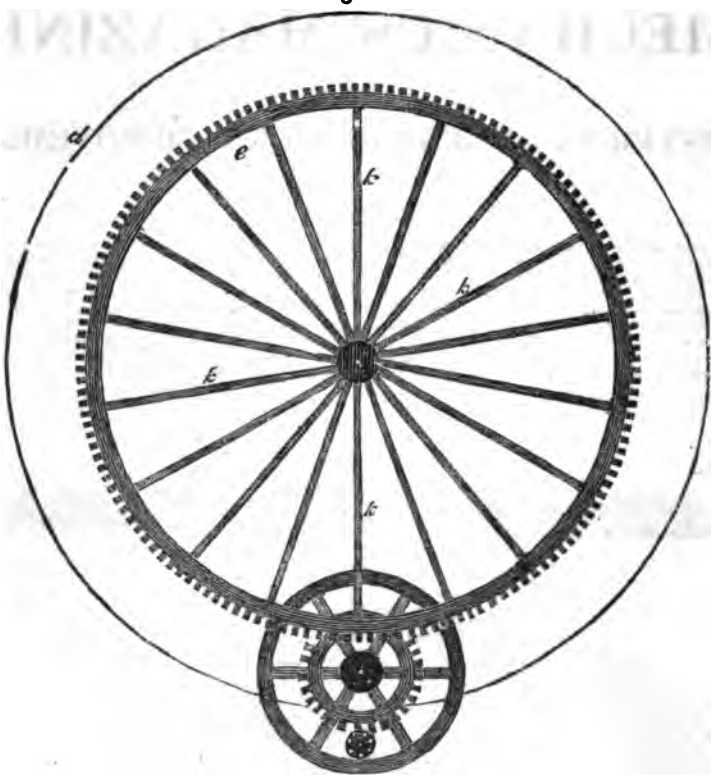


Scale of Vienna Fathoms.

The Art of Brewing—Ox Mill used in the Breweries of Vienna. [From the London Mechanics' Magazine.]

Of the treatises published under the superintendence of the Useful Knowledge Society, one of the very best was that on the "Art of Brewing," by Mr. David Booth; but owing (we believe) to some misunderstanding between the author and the Society, it was left in an incomplete state—two parts only, instead of four, having received the Society's *imprimatur*. Mr. Booth has,

Fig. 2.



under these circumstances, been induced to give Parts III. and IV. to the world through another medium.*

Part IV. is appropriated to brewing in foreign countries, and treats of the art as practised at Munich, Prague, Vienna, Berlin, Brussels, Louvaine, &c. Mr. Booth states, "that for the greater portion of the information in this chapter he is indebted to the manuscript and oral communications of two German brewers (from Vienna and Munich), who have been, and now are, visiting the principal towns of Europe, for the laudable purpose of acquiring information concerning their business."

From this part, being that which contains the most novel information, we shall make a few extracts.

And first, as to the *Bavarian beer*, which, when in prime condition, is "as bright as wine, and contains so much carbonic acid, that it is, in that respect, similar to champagne."

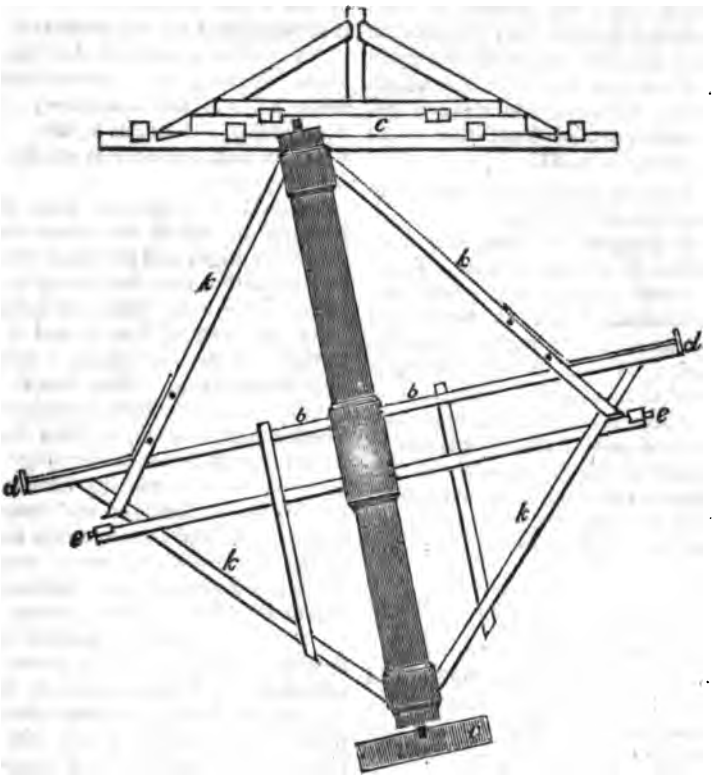
"The beer throughout all Bavaria is nearly of the same strength: usually between 3¼ and 3½ barrels to a quarter of malt. It is made wholly from malted barley and hops; and all sold at an uniform rate, which is fixed by law every year, according to the price of barley; so that there is but one kind of malt liquor for all classes, from the prince to the peasant. The rate for the present year is 16s. per barrel. The beer pays no duty; but the malt must be ground at a public mill, where an impost is levied, amounting to about half of its original value. The malt is screened before carrying it to the mill; and being generally cut with stones, it is also previously damped, in order to prevent the loss by dust. This operation is performed by sprinkling with a watering pan, at the same time frequently turning the heap till it has been well mixed with about two gallons of water to the quarter; and then leaving it to soak for nine or ten hours, that the moisture may penetrate to the centre of each grain. When the malt is to be bruised with rollers, this damping is not considered necessary."—p. 25.

* * * *

"The cellars in Munich are very deep under ground, so that the temperature never rises higher than between 7 and 8° of Reaumur, which is from 48 to 50° of Fahrenheit. In some of them ice is preserved through

* The Art of Brewing. Parts III. and IV. By David Booth. To which is added an Appendix concerning Burton Ale. London: F. J. Mason. 8vo., 1834, pp. 56.

Fig. 3.



the summer. It is within such cellars that the beer is cleansed, into casks that lie on their side, bung uppermost.

* * * *

"After the beer has thus lain from eight to ten months, it is reckoned to be fit for use; and for that end it is drawn off into small casks as wanted, which are immediately carried out to the publican, and on the same day drank by his customers: so that every publican must be supplied with beer every day from the brewery."—pp. 27, 28.

* * * *

"Great care is requisite in having the store-casks very clean and *sweet* before filling them, lest they should communicate a disagreeable flavor to the beer. In two towns this is effected, after they are well washed, by smoking them with burning sulphur; but in the rest of Bavaria it is done by lining them with pitch. The following is the manner by which this is effected at Munich: The store-casks, in which the beer is cleansed, are previously *pitched* every time for summer beer, and once a year for winter beer. Pitching is practised in this way: one end of the cask is taken out, and two English pounds of pitch for every barrel of its contents, if the pitching has only to be renewed (but double that quantity, if for the first time,) is set fire to on the bottom of the cask, and made to burn until the whole has become perfectly fluid. This being done, the fire is extinguished, by putting in the head of the cask and driving the hoops close; and then the cask is rolled about, and turned in every direction, so that the pitch may be spread over every part of the inner surface, which it will thereby cover with a crust of one eighth of an inch thick. This crust is apt to crack and blister, which causes the necessity of re-pitching every season. The professed object of this manipulation is cleanliness; but it doubtless communicates a peculiar flavor to the beer, which, however, is liked, and consequently required, by the customers of those brewers."—p. 29.

* * * *

"The brewers of this city (Augsburg) wash their coolers with great care, scrubbing them every week with Dutch rushes—the stalks of the *equisetum hyemale;* but, notwithstanding this apparent regard to cleanliness, they have one practice which we, in this country, should not venture to imitate. Like the rest of their countrymen, they

pitch their store-vats; but instead of waiting until the plaster is cold, they cleanse the fermented worts into the vats while the pitch is smoking and burning hot. It is this which gives the peculiar flavor by which the Augsburg beer is distinguished from that of all the rest of Bavaria."—p. 31.

The beer next in continental repute to the Bavarian is that of Prague.

"The city of Prague has been famed for its breweries from time immemorial. These constitute the chief support of a great proportion of its inhabitants; and the beer, next to that of Bavaria, is accounted to be the best in Germany. The mode of brewing is very similar to that which is practised at Munich. The brewers in the city draw one hundred gallons of beer from the quarter of malt, while those of the suburbs make ten to twelve gallons more; and, notwithstanding, the beer of the latter has a more agreeable taste than that of the former."—p. 31.

* * * *

"The beer vaults of Prague, of which every publican has one, are of the very best kind. The floor of each is covered with a deep mass of ice, which never melts, and upon this mass the beer is placed, when received fron the brewer. After it has lain from four to six weeks on its icy bed, it is fit for drinking, and is served out to the customers in that chilly state."—p. 33.

In treating of the method of brewing at Vienna, Mr. Booth gives the following description of a species of tread-mill, by means of which oxen are employed to drive the mill stones and rollers (for bruising the malt), which, though "little, if at all, known in this country," he thinks deserving of more extensive publicity, "believing that it would prove a cheap and convenient power in certain situations." We copy also, by permission of Mr. Booth, the engravings to which the description refers:

"Fig. 2 is a section, showing the position of the tread-wheel, *d d*, with respect to its angle of elevation as compared with the horizontal portion of the roof *p p*. The shaft *a*, at right angles, and fixed to the tread wheel, turns on pivots at the top and bottom, which are inserted into strong timber-work. The cog-wheel *c c*, parallel to the tread-wheel *d d*, and also fixed through its centre to the shaft *a*, communicates its motion to such other parts of the machinery as may be required. The wooden spurs *k k k k* sustain the tread-wheel, above and below, uniting a little above the cog-wheel, and fastened at their ends into the shaft. The rim *d d*, being that portion of the circumference of the wheel on which the ox treads, is further supported by the timbers *b b*.

"Fig. 3 is a view of the cog-wheel from above, showing its communication with the other parts of the machinery, such as the fly-wheel *f*, the crank *h*, &c. The spurs *k k*, &c. which preserve it steady in its place, are also seen.

"Fig. 1 is a ground plan of the whole building in which the tread-wheel stands. It is very high, and the main shaft is sunk in an excavation five feet deep in the ground-floor. The same letters of reference which mark the parts of figs. 2 and 3 also apply to this. A bar of boards, *l*, is fixed to prevent the ox from falling down into the pit below, should he accidentally get loose. The wooden gangway, *m*, enables him to get up from the stall below to the stage *n*, on which he walks without moving forward.

"We have abridged the description from the original, and consequently have left some of the letters of reference unnoticed; but we have doubtless said sufficient to be understood. When much power is wanted, the mill is sometimes supplied with three or four oxen together, in a team. The scale affixed to fig. 1 also applies to figs. 2 and 3. It is one of Vienna fathoms, which are something larger than English, 100 of the former making nearly 104 of the latter."—pp. 38–41.

It will doubtless be in the recollection of our readers, that the Burton ale brewers, moved by what was said of their peculiar modes of practice in the second part of this work of Mr. Booth's, applied to the Court of King's Bench for leave to file a criminal information against the publishers of the Useful Knowledge Society; and that, in consequence of Mr. (now Lord Chancellor) Brougham's afterwards stating to the Court, on the part of the Society, that they had, after due inquiry, satisfied themselves that there was no ground for imputing to the plaintiffs the use of any thing, save malt, hops, and water, in the manufacture of their beer, the rule to show cause was discharged. It appears, however, from the extract which follows, that Mr. Booth himself (incredible as it may seem) "was never consulted" with respect to these proceedings; and that had he been consulted, as he ought to have been, the records of the court might possibly have told a very different tale:

"On referring to Chapter X., Part II., of the Art of Brewing, which treats of Burton ale, it will be seen, that, in recommending the adoption of certain ingredients, the writer was careful not to impute the use of them to the licensed brewers; he well knew, that

for them every article except malt and hops was illegal, and subjected them to severe penalties. But the question arose, how much was insinuated, and how far such a suspicion might raise a prejudice against their beer—a circumstance directly opposite to the intentions of the author.

"One of the affidavits gratuitously acknowledged the occasional use of flour and salt, to assist the fermentation of the inferior ale; and the jalap, of which it only was said that 'some recommend' for the same purpose (and the use of which is doubted at page 28, Part I.), may as well be left out of the supposed-accusatory list of ingredients. These, then, are reduced to

Salt of steel -	2 oz. to 20 barrels.
Honey - -	1 lb. per barrel.
Sulphate of lime	6 oz. per barrel.
Black resin -	1 oz. per barrel.

"With respect to the proceedings in this prosecution, the writer of the alleged libel, though his character was in some degree at stake, *was never consulted.* It appears, from what followed, that several chemists were employed to analyse the ale, as well as the water of which it was made; and, had he known of their appointment, he would have told those scientific gentlemen, that the honey and resin (granting that they had ever been introduced) *would certainly escape their detection*—that the salt of steel, not being by weight one part in sixty thousand, would possibly be too minute for discovery; and that the sulphate of lime alone would probably be found. The result would have justified the prediction."—pp. 52, 53.

The Undulating Railway—Final Reply of Mr. Badnall to Mr. Cheverton. [From the London Mechanics' Magazine.]

Sir,—Mr. Cheverton's dreadful infliction—HIS ROD—hath, at last, fallen upon me, without his own character, or the good taste of your readers, being, in the slightest degree, "ill-consulted"—without the most distant apparent inclination to render your pages the medium of a personal quarrel between himself and me! HE will not descend to imitate my dull, vituperative style! HE would shudder to characterise an opponent as "a coarse practitioner from the *abattoir!*"—"a mere hacker of flesh and bones!" HE is a man of more gentlemanlike bearing than to fume out false accusations! No, Sir, HE stands upon too lofty an eminence! HIS philosophic and refined understanding could not possibly stoop to mere personal abuse, or controversial subterfuge! No, HE is the very prototype of wisdom!—an immortal emblem of refinement!—a breathing picture of urbanity and peace!—gentle as a lamb—sweet as honey—mild as new milk—"*parfaite amour*" in toto! HE is not the cur who, when he meets with an unflinching antagonist, flies growling and barking to his kennel! HE is not the tame-hearted pugilist who swears that a blow is false because he cannot parry it!—nor is HE slippery as the eel, which, by its twistings, and its twinings, and its slime, evades the grasp of its pursuer, and buries itself in its native mud! No, Sir, Mr. Cheverton is a being of far different stamp!—his mental qualifications—his scientific reputation—his temper—his writings—his sentiments—will *all* bear the test of the most rigid scrutiny! HIS theories will *all* be established by practical results! The halo round HIS head will brighten as each opinion becomes confirmed by experiment! In a word, HIS letters on "the undulating railway," while they will immortalize the fame of the Mechanics' Magazine, will become never-dying monuments of sterling talent and correct observation, from the hour when *that trial* takes place, which a Dalton* has been indiscreet enough to recommend! Till that hour arrives, I almost feel inclined to "leave him alone in his glory," in order that I might, with double effect, magnify his transcendent name, and prostrate myself before his living monument of wisdom! But—I cannot resist the inclination which his letter has excited, to pay him some passing homage; for neither the "war-whoop of the Mohawk," nor the "inspiring blast of the clarion," shall be compared to the sounding of his brass, or the tinkling of his cymbals!

Yet how shall I, to whom "nature has been so niggardly," sufficiently extol the praise of one who, declining to quarry all ignoble game, is able to defend himself against a weapon capable of dividing "soul from body," the very "marrow from the bones?"

Immortal champion! inspired philosopher! tender and kind-hearted victor! may this humble panegyric be a memento of my deference to thy fame, as long as the Mechanics' Magazine may survive the wreck of time—and may that be for ages!

Having thus, Mr. Editor, in sincere good humor, squared one part of my account with Mr. Cheverton, I beg to acknowledge, like him, the gratification which I feel at the prospect of this too lengthened controversy being terminated. The venom which he thought it prudent, *in the first instance*, to cast on me, I good-humoredly endeavored to throw back; but his last effusion was of so different a nature—so characteristic of a noble and unoffending disposition, that I have met, as it deserved, with an unbounded expression of veneration. As you have admitted, in your valuable columns, his unmeasured declamations, I trust that equal justice may be done to me; and that you will, by publishing this reply, permit me the opportunity of proving that he who cannot, by fair and manly argument, defeat a literary or scientific opponent, stands little chance of doing so by an opposite course of conduct.

Such was my object in noticing Mr. Cheverton's extraordinary letter (vol. xx. p. 73). Had it been otherwise, my silence should have

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* Alluding to the trial of the undulating railway, which Drs. Dalton and Lardner have recommended to be instituted on the London and Birmingham line.

shown my contempt for the vulgar sneers and false accusations with which that document abounded. But it is passed, and I congratulate Mr. Cheverton on the victorious result of his attack.

As no unnecessary time will now be lost in trying, by ample experiment, on some line or other, the merits of the undulating question, I would propose, to your readers in general, that all further controversy should rest until the experiment be made. Practice can alone determine whether I or my opponents have been right or wrong in our anticipations, and whether Mr. Cheverton's arguments or mine will be creditably substantiated. The note which you have attached to my last communication leads me to hope that you may concur in my present opinion ;* and if so, while Mr. Cheverton may try at his leisure any further experiments he may please at the National Gallery of Practical Science, I will direct my attention to the means of elucidating the problem in a far more satisfactory way. If, on a trial being made, I find myself in error, I will frankly confess my incompetency to argue this subject, and my folly at having so warmly and so boldly espoused it—if otherwise, I trust there are many of your readers who will give me credit for some patience, and for some intellectual capabilities beyond the *canaille* sphere in which Mr. Cheverton has been so anxious to place me.

The test shall not be less difficult than I originally proposed. Whether the experimental railway be 6, 8, or 10 miles in length, I maintain that *any locomotive engine will traverse an undulating line, with a load which is its maximum load on a level, in half the time which it will occupy in traversing the same distance with the same load on a dead level railway, and without greater waste or consumption of fuel.* And I, moreover, say, *that any locomotive engine will traverse an undulating line at a great velocity with a load† which that same engine cannot move upon a level line.*

Whenever this trial may take place, your readers shall have ample notice of it ; and if you, Sir, will undertake the office of umpire, I shall cheerfully abide by your decision.

In the mean time, it would be mere repetition, and an unnecessary prolongation of our arguments, were I to reply at length to the more solid parts of Mr. Cheverton's last letter. One or two points, however, I cannot help touching upon. First, as to "*locomotive duty*," which he so frequently harps upon. *All* my arguments, of late, have been almost confined to the practical consideration of locomotive duty. *I do* say that by employing gravity as an *auxiliary* force, *we save* locomotive power. What ! Mr. Cheverton exclaims, can you take advantage of gravity without being obliged to repay what you borrow ? *Yes*, is my reply—and yet *no perpetual motion*, Mr. Cheverton ! How ? Mr. Cheverton would ask. My answer is simply this, and whether it be true or false, *experience will prove—velocity* is *gained* by taking advantage of gravity. *Friction* on railways is, in my humble opinion, *not as the spaces*, but as the *times or velocities*. If this be true—and if a *greater velocity* be attainable on an undulating than on a level railway, there is, (exclusive of any difference in friction arising from the particular inclination of the plane,) *less friction on an undulating than on a level railway*. Locomotive steam power is therefore *saved*.

The next point I wish to allude to is Mr. Cheverton's observations about a lecture given to me, or some of my acquaintances, by Professor ******, in the National Gallery. Does he mean Professor Ritchie ?—if so, I was not present. That gentleman and Mr. Locke had, I know, a conversation together; but the only time that I have had an opportunity of conversing with Professor Ritchie on the subject, was recently, when he did me the honor to spend part of the day with me in Liverpool. In a word, the only individuals whom I can call to mind as having expressed a decided opinion in my presence, when in London, adverse to the undulating railway, were Mr. Saxton and a friend of his, whom I begin to think was Mr. Cheverton ; and as to any acquaintance of mine then present being afraid of their "*badgering*," I *rather think* Mr. Cheverton has imbibed an erroneous impression. If it were necessary, I could publish, in this letter, a list of persons who are advocates of the undulating railway, amply sufficient to out-balance the strongest testimony which Mr. Cheverton and his friends can advance against it,—but the best testimony is *practice*, and *upon that I throw the merits of the case.*

Lastly, Mr. Cheverton offers some important practical objections, which I confess to be more worthy of notice than *any points* which he has hitherto advanced. But, serious as they appear, they will not, on consideration, be found of any real weight. In the first place, we have to determine what is a *safe velocity*—that being determined, how can it be attained on a level railway with heavy loads ? Unless gravity be employed at starting, as an auxiliary force, a much more powerful engine would be requisite to *move* a heavy load from a state of rest, than to continue it at a given maximum velocity ; and *if gravity be employed at starting*, the engine and load *must ascend again to a like summit*, in order to maintain the starting advantage ; and *if so*, what is this but an undulating railway ? Does Mr. Cheverton imagine that a perfect cycloid, or a perfect arc, alone constitute my idea of an undulation ? Far from it—he may descend a hill, run four miles on a level, and ascend to an equal elevation ; and by doing this would realize a system of undulation which might, probably, be adopted with advan-

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* We do perfectly ; but it must be with reservation to the claims of Mr. Whitehead and Mr. M'Kinnon, to whose papers, in opposition to the undulating system, (now many months in hand,) we stand pledged to give insertion. We shall be glad to have their assent to the proposed postponement in the text.—Ed. M. M.

† It will occur to your readers that I have frequently stated as my opinion, that an engine would convey, on an undulating line, *at least* twice the load which the same engine could move on a level, at the same velocity. Such is my opinion now ; but the test which is above proposed will, I am sure, be deemed sufficient to decide the question at issue, and it will be found to accord with the terms of my original challenge.

tage in some cases; for, with heavy loads, a velocity might be generated by the first descent which could not, with the same engine, be generated on a dead level; and this being maintained on the level, would enable the load to ascend to a like elevation. But supposing the undulations to be a series of regular segments of circles, wherein consists the difficulty of sustaining an average velocity of 20 or 30 miles per hour, without an increase of speed? Is it necessary to work the engine down every descent? One of the leading advantages which I anticipate is the great saving of that steam expenditure which is now necessarily incurred in maintaining high velocities on a level. Again, it will require very powerful engines to attain high velocities, with heavy loads, on level railways: whereas, such powerful engines will *not* be so necessary on undulating railways, and for the reasons previously stated.

I now, Sir, unless again attacked by Mr. Cheverton, close with pleasure this twelvemonth's warfare, anxiously awaiting the result of practical trials; and sincerely hoping, although a few waspish observations have occasionally intermingled with a subject to which they should have been altogether foreign, that some information and benefit may have been derived from the discussion.

I am, Sir, with great respect, your very obedient servant, R. BADNALL.

Douglas, March 27, 1834.

P. S.—S. Y. and I have, in one respect, misunderstood each other. He is certainly right in believing that the pressure upon an inclined plane, (alluding to the force necessary to draw a body up,) is as the base to the length: therefore, at an angle of 45°, my statement appeared erroneous; but, taking into consideration the resolution of the forces—that at an angle of 45° the length of the base is equal to the perpendicular elevation—and that taking the length of the plane as the entire force of gravity, it forms the diagonal to two equal sides of a square; the oblique forces are therefore equal—that is, at an angle of 45°, the force of gravity which urges a body down a plane, or retards its ascent, is exactly equal to the force of pressure on the plane. For instance, if L be the length, B the base, and E the elevation, at an angle of 45° E is equal to B; and although the pressure on the plane is $\frac{B}{L} \times L$, yet the tendency to descend is $\frac{E}{L} \times L$; the one force therefore, is equal to the other. I close my discussion with S. Y. with every feeling of respect.

The Editor of the London Mechanics' Magazine afterwards states, that

"'An Attentive Reader of the Undulating Controversy' proposes that a sum of money should be staked on the result of a trial of an undulating line. He requests us to ask, 'Whether Mr. Badnall and Mr. Cheverton have confidence enough in their respective opinions to come forward singly, or supported by their friends and advocates, and stake a sum of money on the event?' He, for one, he adds, 'would be happy to back Mr. Badnall.' The wager, our correspondent suggests, might be laid so that 'the winner should pay for the expense of the trial; which expense, in case of failure, would be merely that of laying down the rails and taking them up again, on any projected line.' The sum he names is from £1,000 to £2,000."

This challenge has brought Mr. Badnall out again, and we presume for the last time. The controversy has been conducted with good feeling on both sides. The result we shall soon know, and our readers shall very speedily be made acquainted with it.

WAGER OF £1,000.—Sir: In your "Notes and Notices" of last week, I observe a correspondent suggests that a wager might be laid between Mr. Cheverton and myself, or our friends, on the result of a trial on an undulating line. Individually, I am not in the habit of offering or accepting bets, but if Mr. Cheverton feel inclined to adopt the recommendation of your correspondent, I shall be happy, on the part of my advocates, to enter, (through the medium of your Magazine,) into an agreement with him, and if he be similarly inclined, to stake £1,000 on the result of a trial on five or ten miles of road. The stakes to be lodged in a banker's hands. I trust that the memorial which has been presented to the London and Birmingham Railway Directors may induce them and their engineer, Mr. Stephenson, to institute, as I anxiously anticipate, an impartial trial on that line of road, *on their own account;* in which case, if Mr. Cheverton be the winner, he will gain £1,000 without deductions. Should he prefer betting a greater sum, I shall be happy to submit his offer to those of my friends who may feel inclined to speculate.

The only sum that I, in conjunction with my partner, Mr. Stephenson, should feel disposed to win or lose, (which may be added to the stakes,) would be the expense of a dinner and wine, at the Albion Hotel, Aldersgate street, for all who have written on the subject, *pro* or *con*, in the Mechanics' Magazine—your worthy self, Sir, being President.

Yours, very obediently,
RICHARD BADNALL.

Manchester, April 7, 1834.

On the subject of the proposed communication by steamboats between Calcutta and England, the Calcutta Courier of the 23d January has the following paragraph:

STEAM COMMUNICATION WITH ENGLAND.—Capt. Ross has proceeded to Socotra in the pilot brig Henry Meriton, taking with him Capt. Jump, who, we believe, will return in charge of the vessel. Capt. Jump is spoken of as likely to be the future commander of the Forbes on her trips to the Red Sea, for which he has tendered his services. In the mean time, arrangements are making to forward coal to the several de-

pots. The Fette Salem is now receiving 500 tons of English coal for Judda, at the freight of 27 rupees per ton,—a very low rate compared with the terms on which the Red Sea depots were provided for the Hugh Lindsay. A suggestion of Capt. Ross is now under the consideration of the committee, to anticipate the departure of the Forbes on the first trip, by altering the date to the 20th April instead of the 1st May, as lately announced. The motive for the alteration is, that starting on the 20th of April, it is believed that the steamer will be able to get down the bay and clear of Ceylon before the earliest period at which storms are to be apprehended.

We understand that the Merchants' Steam Committee have given in a plan to government, offering to undertake to keep up a quarterly communication with England by the Suez route, both from Calcutta and Bombay, with four large steamers of 800 tons burthen, each of them furnished with a pair of 100-horse engines—one of the steamers to run from Bombay, two from Calcutta, and one between Alexandria and the British Channel,—provided government will give them five lakhs annually in compensation for carrying the mail and all public dispatches.

RAILROAD ACROSS THE ISTHMUS OF DARIEN.—We perceive, by the following extract from a Panama paper, that this great enterprize is likely to be undertaken under highly favorable auspices. The results to commerce, from the establishment of a land carriage of this description, between the two great oceans, cannot fail to be of a highly important character.

"To the Deputies of the Provincial Assembly of Panama:

"Gentlemen,—The opening of a carriage road or railway from the Atlantic to the Pacific, has for a long time engrossed the minds of many persons, not only in this capital, but in far distant countries; for knowing the important situation of this province, it is impossible not to conceive the advantages that would accrue, should this new path be opened to general commerce. Such a flattering idea had given rise to various projects to carry this grand work into execution, which have not been realized, perhaps from the lack of a perfect knowledge of the localities, or from a want of sufficient funds, or may be from the political vicissitudes that the country has been subjected to of late. But now that we have fortunately acquired the re-establishment of the empire of the law, and tranquillity has been pretty well secured, I believe that an impulse ought to be given to this interesting undertaking, upon which depends almost the absolute vitality of this declining province.

"With such an object in view, I take the liberty of soliciting that there be granted to me an exclusive privilege, on the same terms that the old chamber of the district granted to Mr. Malcolm M'Gregor, that I might endeavor to get this project put into execution, not doubting that the honorable chamber will receive and protect my request; and being penetrated with its justice and public convenience, will decree favorably. "JUSTO PAREDES.

"Panama, October 2, 1833."

Some days ago, we published an extract from the "Constitucional de Cundinamarca," concerning a project to open a more secure and speedy commercial communication across the Isthmus of Panama. Since then a Panama paper has fallen into our hands, from which we have derived more authentic information regarding this most interesting enterprize. From it we have translated the memorial of Mr. Paredes, which is prefixed to this article. In the same paper, the provincial decree, granting the privilege to that gentleman, also appears, along with a copy of the former one granted to Mr. M'Gregor. The new decree contains some slight modifications of the articles of the old; one of them is, that the road shall reach to the city of Panama, and another, that Mr. Paredes is not bound by the old decree, which only allows two years to carry the project into execution from the day of its passing, otherwise it becomes null and void, but that the new patentee is not bound, nor does he enter into the enjoyment of the privilege until the day that the Governor of the province shall communicate to him that the decree has been approved of by the National Congress.

We feel a considerable degree of pleasure in giving publicity to the Memorial which Mr. Paredes presented to the Provincial Chamber, and which is submitted for approval to the National Congress of New Granada, now sitting, and we cannot for a moment doubt that body will receive kindly a project upon which depends the future happiness, not only of the Isthmus, but also of this Island; for when once such an expeditious communication between the Atlantic and the Pacific shall be opened, will the navigation round Cape Horn be risked, which causes so many dangers and loss of time? Certainly not: for the general deposit will be in this island, from whence will be dispatched the cargoes for the ports in the Pacific, which are now supplied by vessels round the Cape.

It has been also very satisfactory to us to learn that some of the respectable merchants of this city have offered their support to Mr. Paredes, to carry this great work into operation, assuring him that in London a great many more will purchase shares in the company, which, added to those in Jamaica and Panama, will form a sufficient number for the execution of the project, without even counting upon the capitalists of France and the U. States.

We understand that the concessions in favor of the Memorialists could not have been more munificent, whether we consider the extending the privilege to the long period of forty years, or whether we consider the permitting of the exclusive transport of all kinds of merchandize, produce or metals, in carriages belonging to the company. These are truly powerful stimulants, to induce the European and Ameri-

can capitalists to take a considerable share in an enterprize which offers such incalculable advantages. The most authentic accounts that have reached us state that the distance from Porto Bello to Panama is only 14 leagues, and that the expense of putting the plan into active operation will cost nearly half a million of dollars.

The good reputation of Mr. Paredes, his commercial relations with this city, the facility with which he expresses himself in different languages, added to his honorable character and personal activity, incline us to augur well of the undertaking, whilst the grandeur of the enterprize makes us quite sensible of his patriotism, his judgment, and the knowledge which he possesses of the important situation of his country. If every Colombian thought as he does, that country would soon prosper, and instead of civil war and intestine quarrels, peace, good order and tranquillity, and industry, would be established upon the firmest basis.—[Kingston, Jam. Chronicle.]

DRAINING.—The following, from the Farmers' Register, affords an instance of great perseverance. The writer disapproves of covered drains. They are, however, far the best, except where a large body of water is to be carried off.

"My main drain," says he, "is something less than 3000 yards in length, having the capacity to receive and discharge the spring and flood water from seven or eight thousand acres of land. 1800 yards were cut through a mill pond, which was made by a dam not more than two and a half feet high, which is now put down, by the kindness of the owner. Much of the country around is precipitous and broken; the water from which brought great quantities of sand and mud into my drain, and often made it necessary to clean it out fall and spring. This alone was great labor. Thirty-three years have passed over me since I began the work, and I cannot say that it is perfect. A drain like this must have no angles in it; for they create eddies, in which all washings will be left, and the work ultimately ruined. This important fact in draining I had to learn by experiment; and upon so long and crooked a stream, (and that a boundary,) to straighten all the angles, and make the drain at my own cost and loss, was not exactly pleasant. As a short rule for making drains, let me say that they should be *straight*, and of *full* capacity to contain the water thrown into them, always taking care to begin at the outlet or lowest point. By measure and estimate, sufficiently accurate for all my purposes, I have not less than thirty thousand yards of water and fence ditching, fifteen-sixteenths of which is necessary to the drying and draining of my farm. Not less than one-quarter of all these must be scoured and cleansed every year. Like a gambler, I was drawn into this work by imperceptible degrees, and finally played on because I had already lost so much. Separately considered as a matter of profit, I am not prepared to justify such expensive works. Nevertheless, they show young farmers that perseverance, with a very limited degree of knowledge and experience, will, in time, surmount what would seem to be insuperable difficulties. Though my land was once remarkable for its great growth of rushes, I believe it would now be difficult to find one. Clover and plaister operate well even upon that land that was covered 50 years by the mill pond. As for covered drains, I have made many, but they were very unsatisfactory; and I would not advise any to make them.

History of Astronomy—its various Systems, &c. [Continued from vol. iii., p. 298.]

ON LIGHT.

Fairest of beings! first created light!
Prime cause of beauty! for from thee alone
The sparkling gem, the vegetable race,
The nobler worlds that live and breathe their charms,
The lovely hues peculiar to each tribe,
From thy unfading source of splendor draw.
In thy pure shine with transport I survey
This firmament, and these her rolling worlds,
Their magnitudes and motions.—[Muller.]

The nature of light has been the subject of speculation and conjecture among philosophers, from the first dawnings of philosophy to the present day. But of all the conjectures which have been advanced on this curious and interesting subject, there is scarcely one supported by evidence sufficient to entitle it to preference over the other. There are, however, two opinions on this subject which have prevailed more generally than any of the others, and therefore it may be proper to notice them here, although the design of the present work is rather to state what is *known* respecting any phenomenon than to indulge in conjectures concerning it.

The celebrated Huygens considered light as a subtle fluid filling space, and rendering bodies visible by the undulations into which it was thrown. According to this theory, when the sun rises it agitates this fluid, the undulations gradually extend themselves, and at last, striking against our eyes, we see the sun. This opinion of Huygens was adopted by Euler, one of the best mathematicians that ever lived, who exerted the whole of his consummate mathematical skill in its defence. Sir I. Newton, and many other distinguished philosophers, consider light as a substance consisting of small particles constantly separating from luminous bodies, moving in straight lines, and rendering other bodies luminous by passing from them and entering the eye. Newton has been at great pains to establish this theory, and has certainly shown that all the phenomena of light may be mathematically deduced from it.

While Huygens and Euler have attempted

to support their hypothesis, rather by starting objections to Newton's than by bringing forward direct proofs, Newton and his disciples, on the contrary, have shown that the known phenomena of light are *inconsistent* with the undulations of a fluid, and that on such a supposition there can be no such thing as darkness at all. They have also brought forward a great number of direct arguments in support of their theory, which it has been impossible to answer.* But without giving a decided preference to any theory, we shall proceed to state some of its properties.

Roemer, a Danish astronomer, while engaged in making observations on the satellites of Jupiter, found that in eclipses they emerge from the shadow at certain times a few minutes later, and at others a few minutes sooner, than they ought to have done, according to the tables which had been previously constructed to show the times of their revolutions, eclipses, &c. On comparing these apparent irregularities together, he found that the eclipses happened before or after the computed time according as the earth was nearer to or farther from Jupiter. Hence he formed the ingenious conjecture, which was soon demonstrated to be the case, that the motion of light is not instantaneous, as was then generally believed, but that it required a certain portion of time to pass from the luminous body to the eye of the observer. According to Roemer's calculation, it was about *seven minutes* in traversing the radius of the earth's orbit; but it has since been found, that when the earth is exactly between Jupiter and the sun, his satellites are eclipsed about 8¼ minutes sooner than the time found by the tables; but when the earth is nearly in the opposite point, these eclipses happen about 8¼ minutes later than that determined by the tables. It is therefore concluded, that light takes about 16½ minutes of time to pass over a space equal to the diameter of the earth's orbit, which is at least one hundred and ninety millions of miles; it therefore moves at the rate of nearly 200,000 miles per second, which is about 10,300 times faster than the earth in its orbit, and 1,550,000 times quicker than a cannon ball.†

The velocity of light being known, it is easy to know the time it requires to arrive at the earth from any of the planets, or even the fixed stars, if their distance be known. For it has been ascertained, that the reflected light of the planets and satellites travels with the same velocity as the direct light of the sun or fixed stars; and that the velocity is the same from whatever distance it comes.

The discovery of Roemer has been completely confirmed by another most important discovery made by our countryman, Dr. Bradley, while engaged in making a series of observations with a view to determine the annual parallax of the fixed stars. This celebrated astronomer found that the aberration or difference between the true and apparent place of a fixed star is occasioned by the progressive motion of light, combined with the motion of the earth in its orbit; and that this *aberration*, when greatest, amounts to 20″·232. Now, the earth describes an arc of 20″·232 in 8′ 13″, the time that light takes to pass over the semidiameter of the earth's orbit. This circumstance, therefore, not only affords one of the most convincing proofs of the motion of the earth in its orbit, but entirely overthrows both the Ptolemaic and Tychonic systems, and completely establishes the motion of the earth.

As the rays of light are known to proceed only in straight lines from luminous bodies, and as the earth is constantly moving forward in its orbit, it is evident that a ray of light proceeding from any celestial body, will impinge on the earth at a different point from what it would have done had the earth been stationary. It is therefore necessary, in making astronomical observations with nicety, to make allowance for the aberration. When a fixed star or planet, for example, is seen through a tube or telescope, the tube does not point exactly to the *true* place of the star or planet, but to its *apparent* place, which is always more advanced in the direction we are moving than its true place, by a quantity equal to the aberration of the object.* But this will, perhaps, be better understood by the following illustration, which is given by Mr. Maupertuis, in his Elements of Geography.

"The direction," says he, "in which a gun must be pointed to strike a bird in its flight, is not exactly that of the bird, but of a point a little before it, in the path of its flight; and that so much the more as the flight of the bird is more rapid, with respect to the

* M. Delavel maintains that all light is reflected by white particles, and colored in its transmission. No transparent medium reflects any light when examined within a blackened bottle; this is shown by experiments on sixty-eight kinds of fluids, and on many kinds of glasses, and other substances. For this, and for the colors of the sea, M. Delavel proposes a very singular theory; but those who wish to become particularly acquainted with it, must consult his work on the permanent colors of opaque bodies.

† The real time which light takes to pass from the sun to the earth is 8 minutes 13 seconds.

* The aberration not only affects the longitude of a star or planet, but also its altitude, declination, and right ascension.

flight of the shot. In this way of considering the matter, the flight of the bird represents the motion of the earth, and the flight of the shot the motion of the light proceeding from the object."

Many philosophers have attempted, not only to compare the light of the stars with that of the sun, but also to ascertain their distances by comparisons of this kind.

The Rev. Mr. Mitchell, in an elaborate and ingenious paper in the Transactions of the Royal Society, states, that our sun would still appear as luminous as the star Sirius, although removed to 400,000 times his present distance; and that the fixed stars cannot be nearer than this, if they be equal to the sun in lustre and magnitude, and that they are so is the opinion of the most celebrated astronomers of the present day. Euler, who has already been mentioned, makes the light of the sun equal to 6,500 candles at one foot distance; the moon equal to one candle at 7½ feet distance; Venus to one at 421 feet; and Jupiter to one at 1320 feet. From this comparison it follows, the light of the sun exceeds that of the moon 364,000 times. It is therefore no wonder that the attempts which have been made by some philosophers, to condense the light of the moon by lenses, have been attended with so little success. For, should one of the largest of these lenses even increase the light of the moon one thousand times, still, in this increased state, it will be three hundred and sixty-four times less than the intensity of the common light of the sun.

The intensity of light has been found to vary as the square of the distance; for if an object be placed one foot distant from a candle, it will receive four times more light than when it is removed to double the distance, nine times more than when it is removed to three times the distance, and so on.

Of the Atmosphere and Astronomical Refraction.—The earth is surrounded by a thin fluid mass of matter, called the air, or atmosphere, which revolves with it in its diurnal motion, and goes round the sun with it every year. This fluid is both ponderous and elastic. Its weight is known from the Torricillian experiment, or that of the barometer; and its elasticity is proved by simply inverting a vessel full of air in water.

The atmosphere at the earth's surface being pressed by the weight of all above it, is there pressed the closest together; and therefore the atmosphere is densest of all at the earth's surface; and its density necessarily diminishes the higher up. For each stratum of air is compressed only by the weight of those above it; the upper strata are therefore less compressed, and consequently less dense, than those below them.

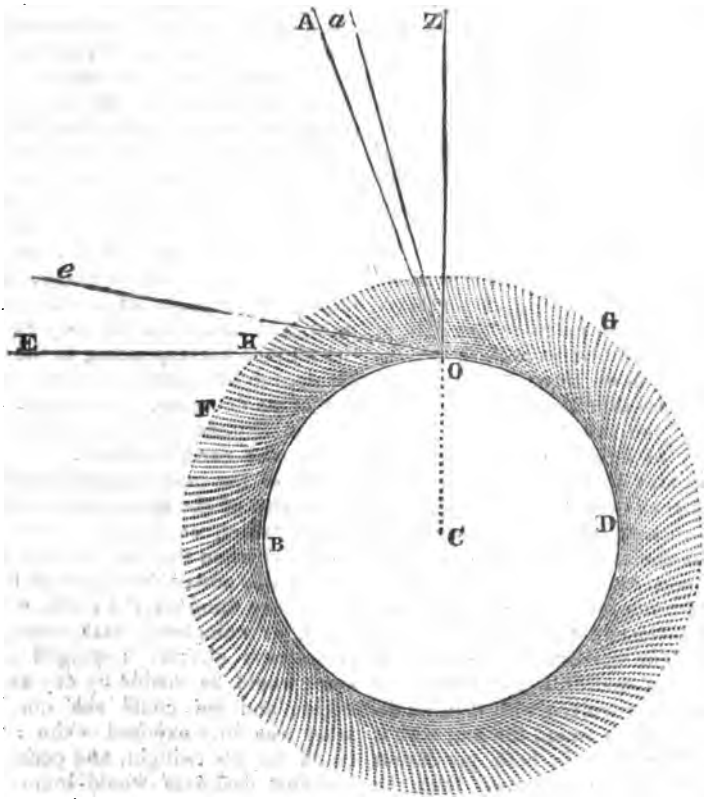
The pressure or weight of the atmosphere has been repeatedly determined, by various experiments, to be about fourteen pounds on every square inch of the earth's surface. Hence, the total pressure on the whole surface of the earth is 10,686,000,000 hundreds of millions of pounds avoirdupois.

From a number of experiments made on the density of the atmosphere, at various altitudes, by means of the barometer, it has been ascertained, that if heights from the earth's surface be taken in arithmetical progression, the density of the corresponding strata of air decreases in geometrical progression. Thus the density of the atmosphere is reduced one half for every 3½ miles of perpendicular ascent. At seven miles in height, the corresponding density is only one fourth; at 10½ miles, one eighth; at 14 miles, one sixteenth: and so on. Since the density of the air decreases at this rapid rate, it is evident that at a very moderate distance from the surface of the earth its density would be so much diminished as to render it incapable of sustaining animal life. From observations and experiments, it is pretty well known that 45 or 50 miles is the utmost height at which the density is capable of refracting a ray of light, and, therefore, this may be considered the altitude corresponding to the least *sensible* degree of density; for, according to the law of its decrease, just stated, the density at this altitude is above 10,000 times less than at the earth's surface.

One of the most extraordinary and useful properties of the atmosphere is its reflective power, which causes the heavens to appear luminous when the sun shines; for, were it not for this power, the whole of the heavens, and every thing on the earth, would appear black, or completely dark, except what the sun's rays directly impinged upon. The stars would be visible by day as well as by night; and we could see nothing except what was fully exposed to the sun. There could be no twilight, and consequently the blackest darkness would immediately succeed the brightest sun-shine when the sun set; and the transition would be equally sudden from the blackest darkness to the brightest sun-shine when the sun rose. But by means of the atmosphere, we enjoy the sun's light reflected from the aerial particles for some time before he rises, and also for some time after he sets. For when the earth, by its revolution on its axis, has turned any particular place away from the sun, the atmosphere above that place will continue

to be illuminated for some time. However, as the sun gets farther below the horizon, the less will the atmosphere be illuminated; and when he is *eighteen* degrees under the horizon, it ceases to be illuminated, and then all that part of the heavens which is over the place will become dark; for the place will then be turned too far from the sun, and his rays will strike too high on the atmosphere to be refracted or bent downwards at that place. In consequence of the refractive power of the atmosphere, all the heavenly bodies appear higher than they really are: for on account of the variation in the density of the air, a ray of light in passing through it will be refracted at every instant, and consequently the path of the ray will be a curve. And as an object is always seen in the direction in which the rays of light proceeding from it enter the eye, it is evident every celestial body will appear more elevated above the horizon than it actually is, by a quantity equal to the refraction which a ray of light suffers in passing from it through the atmosphere to the eye of the observer.

When the object is in the zenith, the refraction is quite insensible; but it increases as the altitude of the object diminishes, till it reaches the horizon, and then the refraction is greatest; for the rays which proceed from the object, in that situation, enter the atmosphere more obliquely than in any other, and consequently are more turned out of their course. This will be evident from an inspection of the following figure



Where B O D represents the surface of the earth, O the place of an observer, and F G H the surrounding atmosphere. A ray of light proceeding from a body, Z, in the zenith is not refracted; but if it proceed from a body at A, it will enter the eye at O, and appear in the direction O *a*; if the body be in the horizon, as at E, the rays proceeding from it will enter the eye at O, and appear to come in the direction *e* O.

On some occasions, the horizontal refraction amounts to 36 or 37 minutes, and generally to about 33 minutes, which is equal to the diameter of the sun or moon; and therefore the whole disc of the sun or moon will appear above the horizon, both at rising and setting, although actually below. This is the reason that the full moon has sometimes been seen above the horizon before the sun was set. A remarkable instance of this kind

was observed at Paris, on the 19th of July, 1750, when the moon appeared visibly eclipsed, while the sun was distinctly to be seen above the horizon.

At some seasons of the year, the sun appears ten minutes sooner above the horizon in the morning, and continues as much longer above it in the evening, than he would do were there no refraction; and at a mean rate, about seven minutes on any day of the year. The refraction varies, however, very much with the state of the atmosphere. In cold dry weather the air is more dense than in warm weather; consequently the refraction is greater in cold weather than in warm, and for the same reason, it is greater in cold countries than in hot ones.

A remarkable instance of this is mentioned by Dr. Smith, in his Optics, where he states that some Hollanders, who wintered in Nova Zembla, in the year 1596, were surprised to find, that after three months' constant darkness, the sun began to appear seventeen days sooner than the time by computation deduced from the latitude, which was 76 degrees. Now, this phenomenon can only be accounted for by the extraordinary refraction of the sun's rays in passing through the cold dense air in that climate.

At the same altitudes, the sun, moon, and stars, all undergo the same refraction; for at equal altitudes the rays which proceed from any of these bodies suffer the same inclination.

The horizontal refraction being the greatest, causes the sun and moon, at rising and setting, to appear of an oval form; for the lower edge of each being seen through denser atmosphere than the upper edge, is more refracted, consequently, the perpendicular diameter must appear shortened, while the horizontal diameter, (which is not affected by refraction,) remains the same, and in this way the oval appearance is produced. For the same reason, two fixed stars that are near the horizon, and right above each other, appear nearer than when they are high above the horizon; and if they are both in the horizon, but at some distance from each other, then they will appear at a less distance than they really are; for the refraction makes each of them higher, and consequently must bring them into parts of their respective vertical circles, which are nearer to each other, because all vertical circles converge and meet in the zenith. Hence, in all astronomical calculations, allowance must be made for refraction, before the true altitude of any celestial body can be obtained. Tables containing this allowance for all altitudes are to be found in every work on practical astronomy.

The atmosphere not only occasions celestial bodies to appear higher than they really are, by bending the rays of light as they pass through it, but it also affects terrestrial bodies in the same way. The quantity of this refraction is however found to vary considerably with the different states of the atmosphere, and is therefore very uncertain. But, at a mean rate, it may be taken at one fourteenth part of the distance expressed in degrees in a great circle: or, according to Professor Playfair, it is about one seventh part of the correction for the earth's curvature, answering to the distance between the observer and the object.*

Steamboat Travelling.—The cabins of western steamboats present peculiar aspects. They possess all the splendor and comforts of an eastern boat, and afford other pleasures which we meet with no where else. A person embarking in a steamboat generally expects to remain on board for a longer time than is necessary to perform the trips elsewhere. He prepares himself for the formation of new acquaintances. The boat gets under-way, and no one holds himself aloof from the advances of his fellow voyager. A feeling of general interest is soon acknowledged and felt. Intimacies are entered into, and each one contributes from his own resources to the general fund of amusement. By this means the hours are beguiled of their weariness, and that, which under other auspices would be tedious, becomes a source of pleasure.

But the most inveterate talkers will tire. Recourse must be had to other resources. If the voyager has been considerate, and supplied himself with those mute, yet ever interesting companions, agreeable books, he is at no loss. But if he have not prepared himself with a shield against the attacks of enemies, he is in a pitiful condition. He lounges about the cabin—promenades the guards—gapes at the sublime scenery of the river hills—and eventually, in a fit of desperation, throws himself into his berth, and seeks, in the oblivion of sleep, to forget that he is a bore to himself. Perhaps an ingenious companion, who is similarly conquered by dullness, devises an expedient for relief. Gaming, we are sorry to say, is much too

* For example, suppose the distance between a person and any conspicuous object to be 5 English miles, and he wishes to know how much it is elevated by refraction. The correction for the earth's curvature on this distance is 161 feet, one seventh part of which is 2 feet 4½ inches, which it is raised by refraction.

common; and no one must consider a proposition to have recourse to that dernier resort of dullness, as any other than a genteel proposition. A proposition is made that the tedium of the hours be lost in the excitement of the card-table. Such propositions are frequently acceded to.

Now, we believe many can date the commencement of their sinning in this way from a vacant hour of steamboat travelling. A taste for such excitements has thus been originated, which has eventuated in the moral degradation of its victims. If any expedients can be adopted to guard against such occurrences, they should be entered into by such as are desirous for the welfare of their fellows with alacrity.

An interesting book, by affording agreeable entertainment, would preserve the mind from the dreary inaction of lassitude. The sickly feeling of satiety is exceedingly propitious for the advances of vice. No man when under the influence of a healthy intellectual activity wishes for change. It is in those moments when that by which we are surrounded fails to yield us pleasure, that we sigh for change, and are most liable to listen to the voice of the tempter. The seductions of vice are yielded to, and inroads are made on our moral principles. The enemy once having got possession of our bulwarks, our condition is exceedingly precarious.

Under the weight of such considerations, we plainly discover the great utility of healthy excitement. If each steamboat possessed a small library of well selected works, a pleasant resource would be afforded. The expense would be but small. The advantages would be great. A steamboat with a library on board would be preferred by every sensible man, to one which was unprovided with books. We commend the consideration of these suggestions to those engaged in fitting up steamboat cabins, and who are disposed to lessen the evils of humanity.—[Cincinnati Mirror.]

MORAL PRINCIPLES THE SAFEGUARD OF LIBERTY.—The following, from the Scottish Guardian, although not correct in all its statements or reasoning, deserves, says the Annals of Education, deep reflection, and we have been gratified to see it circulating extensively through our newspapers.

Two Magistrates of Paris recently made a tour through the United States, and in the course of two years collected important information regarding the statistics of crime and education. In the state of New-York, 500,000 children, out of two millions, are at public schools: that is, a *fourth* part of the population; and £240,000 are annually expended for this purpose. Yet in this State crime increases, and that, too, though the means of subsistence and employment are so much more easily obtained than in any other countries. In Connecticut, education is still more extended, and nearly a *third* part of the population is at school. Yet crimes multiply to a frightful extent. The Journal of Education, stating these facts, draws this cautious conclusion: "If knowledge cannot be accused of *causing* this increase of crime, at least it has not *prevented* it."

On turning to France, and examining tables of the comparative proportion of instruction in its different departments, during a period of three years, the western and central provinces have been found the most uneducated—15, 14, 13, 12, and 8 per cent. only being able to read and write; but, according to an essay on the moral statistics of France, presented to the Academy of Sciences, the *minimum* of crime is to be found in these uneducated departments, and the *maximum* in Corsica and in the south-eastern provinces, and in Alsace, where nearly half the population can read. The different employments of the population may account for the difference in part; yet still we may again draw the cautious conclusion, that if education has not *caused*, at least it has not been seen to *prevent* crime.

The only ascertained moral effect of intellectual education was stated in last March by the Lord Chancellor, in the House of Lords. In Russia, where education can scarcely be said to exist, out of 5,800 crimes committed within a certain period, 3,500 were accompanied by violence; while in Pennsylvania, where education is generally diffused, out of 7,400 crimes, only 640 were accompanied by violence, being in the proportion of $\frac{1}{12}$ of the whole number, instead of $\frac{2}{3}$, as in the former case. Thus the only ascertained effect of intellectual education on crime is to substitute *fraud* for *force*—the *cunning* of civilized, for the *violence* of savage life. Nor would even this small change be permanent. A highly intellectual community, without moral principles and the habits of self denial which religion imposes, would only prove a sleeping volcano, ready to awaken every moment, and overthrow those very institutions under which it had been fostered. To increase the intellectual power, and enlarge the knowledge, of a man void of principle, is only to create in him new desires, to make him restless and dissatisfied, hating those that are above him, and desirous of reducing all to his own level; and you have but to realize universally such a state of society, to fill the cup of the world's guilt and misery to the *brim*. What do we say then? Not certainly that education is to be withheld from any member of society,—for that question is now decided, whether we will or not,—but that from the infant school, upwards to the university, it must be a thorough *Christian* education, in which our youth shall be trained in the ways of virtuous self-control, and piety and righteousness wrought into the understanding and into the whole habit of man. A perfunctory religious

education will no longer serve—not mere Bible reading, but Bible education. The understanding must be enlightened, and the heart must be gained over to the side of truth and righteousness. In short, *the grand aim of education* must become, not merely the formation of intellectual habits, or the acquisition of secular knowledge, (as is too exclusively the case in present times,) but the formation of the Christian character. Men have hitherto been prone to take for granted, that it was only necessary to teach the art of reading, and before this new power all vice and error would flee away. These are dreams of men ignorant of themselves, and ignorant of our poor nature. Men must be trained to piety and virtue as they are trained to any other habits, whether intellectual or physical; and the moral man must advance contemporaneously with the intellectual man, else we see no increase from our increased education, but an increased capacity for evil doing.

The following application of this truth to our own country and its peculiar dangers, from the Northampton Courier, is another gratifying evidence of the increased interest taken in the subject.

"We believe that there is much truth and justice in the remark, that other influences besides that of force must be exercised, to keep the Union of these States permanently together. Statutes may be enacted, constitutions framed, and interests multiplied, but if there is not a primary feeling of moral obligation and fraternal duty, to cement and enforce them, the duration of this government, like all others, is extremely questionable and uncertain. Pecuniary interest, and common defence, and general prosperity, are but transient ties, which can be thrown off to suit the excited spirit of the times, or changed to meet any pressing emergency. They are but selfish bonds, which yield at the rude touch of popular disaffection, and are easily rent by the misguided voice of public sentiment, and vindictiveness, and clamor. But if legal enactments and obligations, and physical wants, and common defence, do not constitute security against dissolution, what influences can be exerted to sustain and strengthen a civil compact of such stupendous weight and importance as our own? If these things fail, what iron will enter the souls of men, to enforce their moral obligations, and to impress upon them the maxim of 'union,' with certain safety and security?"

We think a *moral* obligation, and religious feeling, and fraternal affection, which is founded in the heart, and has its emanations from the soul, if rightly cultivated, will insure this purpose, and guarantee its permanent duration. Some deep abiding sentiment, some strong affection of the mind, some radiating influence from the heart, which rises above selfishness, and pecuniary wants, and sordid interest, which all feel and acknowledge, is what should be cherished and cultivated, to bind with adamantine chains the different parts and sections of this our own favored country together.

Yes; it is by cultivating the sense of 'moral obligation and religious feeling,' and the 'fraternal affection,' which is their necessary concomitant and result, that our own union is to be maintained, (for we are unwilling to add the qualification which is chilling so many hearts,) and not by constitutions of parchment, or even by the arm of power. If our laws are not supported by our feelings, and principles, the force which we use to maintain them may indeed make us *fellow prisoners*, or *fellow subjects*, but never can unite us as *brethren* or *fellow citizens*. France has long sought to establish moral principle on some other basis than that of Christianity; but she has renounced this visionary plan, and now requires the *New Testament* to be employed as the text book of morals and religion in every school in the empire. Let us profit by her example, and retain the precious legacy of our purer, happier ancestors.

Examples of Self-Education.—It is not a little encouraging to those who long for the advancement of society, to see the results of that education which is gained by some in the school of nature and providence, with little of the aid of man—and in this view we publish the following example.

Mr. Ewing, U. S. Senator from Ohio, is perhaps the most conspicuous man in this State at the present time, unless Judge M'Lean be an exception. Although he has been in Congress but a single session, he has acquired a high reputation as a statesman. I should think him to be about forty. He is a self-made man—a striking exemplification of what a man can attain to by merely *personal effort*. He is a native of this State, and was born poor. In his youth, his principal employment was wood-chopping. Being very athletic, he excelled in the labors of the axe. At length, when he had become what would be called, 'a great, overgrown, awkward, brawny young man,' by a fortunate jostle, a desire for an education waked in his bosom,—he directed his steps to this institution, where he completed his education preparatory to the study of the law. In term time he chopped wood at the college door—and in vacation, it was his custom to swing his axe upon his shoulder, and go forth in search of a job; which he would accomplish, and return with fresh vigor at the commencement of the next term. In this way he sustained himself while in college, and came out with a constitution as vigorous as when he entered. And now he is a senator of the United States.

A Petrified Papoose.—Some persons employed lately in quarrying stones at Guernsey, Ohio, came across the body of an Indian child completely petrified. This extraordinary specimen was found embedded in a solid mass of rock, and has the appearance of a stone image, somewhat imperfect, to be sure, yet, on the whole, a very fair outline of a young Indian, done in lime-stone. A small row of Indian beads (too hard originally to need petrifaction, we suppose,) was found in the same cavity.

ON THE DIP AND DECLINATION OF THE NEEDLE.

To the Editor of the Mechanics' Magazine:

SIR,—P. G. V. (see vol. iii., page 368) appears anxious that the variations of the compass should be taken by practical surveyors in the United States in June and December, so that in a few years the long sought for problem may be settled. He may in a short time learn, from some observations which have been made in the city of Philadelphia, with great care, several times in the day, for nearly a year past, much of what he wishes to know; and further, that the irregular and disjointed observations of surveyors through the country, giving what they might suppose to be the correct variation of a place, could not be relied on, as it has been known to vary as much as ten minutes in half an hour. To obtain the correct variation, a number of regular observations daily for a length of time would be required, and then a few observers through the country would answer all necessary purposes. W.

An improved Bee Hive.—The box or hive to be made of inch plank, say about two feet three inches by twelve inches wide; the upper part of the box to be partitioned off, allowing just space sufficient to admit a drawer of about ten by twelve inches deep. This drawer is to slide upon the horizontal partition, and to be made to fit the inside of the box exactly. In the bottom of the drawer a hole is to be made, say about one and a half inch in diameter, and a corresponding one in the partition, so as to allow the bees to pass up from the lower part of the hive into the drawer. In the outer side of the drawer, a pane of glass is to be fixed, in order to ascertain when the drawer is filled with honey. Over the glass, a sliding shutter is to be placed, to exclude the light; or the upper end of the plank, forming the back side of the box, or hive, may be sawed off, and fastened with a hinge and button, so as to answer in place of the sliding shutter. When the honey is wanted for use, remove the shutter from before the glass, and having ascertained that the drawer is filled, introduce a little smoke into the top of the drawer by means of a tobacco pipe; and when the bees have been driven into the lower part of the hive, separate the drawer and partition with a case knife, remove the drawer, and having emptied it, return it to its place again, and the bees will commence working in it immediately. By this method the honey will be always pure, without bee-bread, or dead bees, and not a single bee need be destroyed; and moreover, it has been tested by many years' trial, and found to answer the intention completely. Z.

P. S.—The drawer should have a top *screwed* on, so as to be more readily opened when the honey is to be taken out; and any space between the drawer and the sides, or top of the hive, should be filled with some kind of cement, so as to prevent insects from making a lodgment within the hive.

IRON WHEELS.—We saw a waggon in Court street this forenoon, which, from the novel construction of the wheels, excited considerable curiosity in the passers-by. They were made entirely of iron—the outer part of the wheel was formed from a single piece of iron about an inch and a half square—the spokes were round, and five-eighths of an inch in diameter. The naves were constructed in a new and ingenious manner, by which the friction is much diminished; and the whole appearance of the wheels conveyed the idea of usefulness, neatness, and simplicity.

On inquiry, we learned that these wheels were calculated to sustain a weight of a ton and a half—and that wheels of the ordinary construction, to sustain so great a weight, would weigh about the same as these newly invented wheels. The expense also, we were informed, will not vary materially from those in common use. They were manufactured by Mr. Hale, of South Boston; and we believe this is the first attempt of the kind to manufacture all the parts of the wheel of iron. The advantages to be derived from this invention are neatness, safety, and durability.—[Boston paper.]

SHEET IRON GIGS.—These gigs are continuing to grow as rapidly numerous as they are increasing in public estimation. A very beautifully fitted up one was this week finished by Messrs. Reid and Hanna, and Messrs. Walker, for the Paisley Canal. Two others are in a state of great forwardness for Dublin; and several others, for various canals, are also in preparation. This business of gig making has extended to Johnstone, also, where there are six or seven of them getting forward for various canals both in Ireland and Scotland. Steam-coaches will find in these gigs most powerful competitors to contend with.

The increase of trade upon all the canals on which they have been introduced is quite astonishing. The bustle at the basin here and at Port Eglinton, by the hourly departure, is quite enlivening, and we understand the travelling by the Forth and Clyde Canal is increased in a most astonishing degree. Indeed, from the speed they have attained, and the low prices charged to Edinburgh, Stirling, Alloa, &c. no other result could be expected.—[Paisley Advertiser.]

FOSSIL HORNS.—In excavating the Lancaster Lateral Canal, near a place called the "Deep Cut," bones of extraordinary dimensions have been discovered. Among the curiosities found is a horn six feet in length, weighing 44 lbs., and measuring at the butt end sixteen inches. Also, a tooth weighing 6¾ lbs.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $2 per annum in advance.—JOHN TIMBS, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

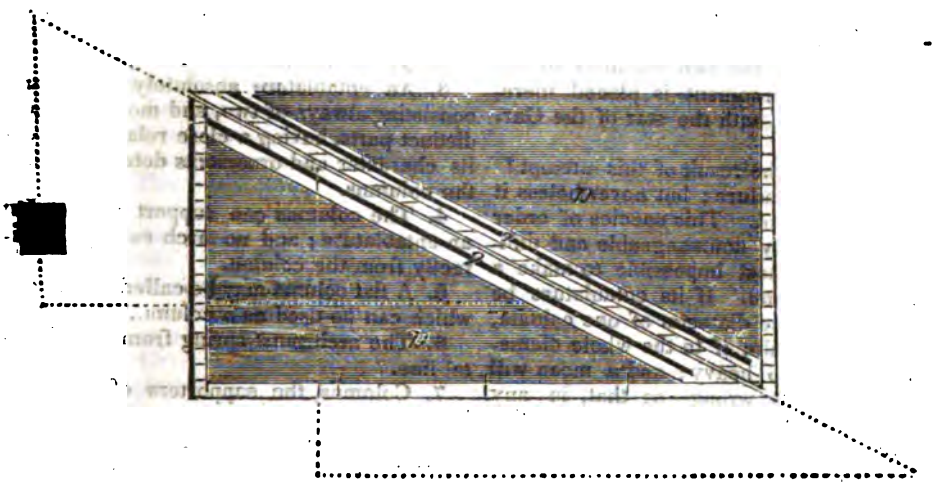
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

Vol. IV.] FOR THE WEEK ENDING JULY 12, 1834. [Number 1.

"It is in the animal body, that true perfection and the greatest variety of mechanism are found. Where so different structure, is to be found a system of levers and hinges, and moving parts, like the limbs of an animal body; where such an admirable apparatus as in the heart and blood vessels; such a *pneumatic*, as in the breathing chest; such *acoustic* instruments as in the ear [illegible] such an *optical* instrument, as in the eye;—in a word, such variety and perfection as in the whole of the animal machine?"—M. Arnott.

PARALLEL RULING MACHINE.



Newly Invented Parallel Ruler for Making of Horizontal and Parallel Lines. [Communicated for the Mechanics' Magazine and Register of Inventions and Improvements.]

To the Editor of the Mechanics' Magazine:

DEAR SIR,—I send you the sketch of a Parallel Ruler executed under my direction by Ewin & Heurtte, of this place, to whom I give the patent right, if they choose to take it.

You will see that the great desideratum of a true parallel ruler for horizontal as well as for perpendicular lines is now accomplished; and that in changing the edges in scales differently divided, engineers and architects will save half of the time in the construction and measurement of their drafts.

REFERENCES.—*a*, common triangles in mahogany or box wood; *b*, groove in brass; *c*, connecting sliding string. The dotted lines show the motion of the upper triangle.

Yours sincerely,

B. PETITVAL, Civil Engineer.

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from vol. iii., page 330.]

COMPOSED ORDERS.

Q. What are composed orders?

A. Specimens of architecture, (even to be met with in Greece and Rome,) whose proportions and composition do not agree with any of the fine orders.

Q. How are they comprised?

A. Under the general name of *Composed orders;* and, though beautiful as small works, scarcely any of the ancient ones are worthy of imitation in large buildings; and modern composition has afforded but few specimens.

Q. What attempt has been made in England to introduce a new order of architecture?

A. A most singular one, some years since, at Windsor, by Mr. Emelyn, an architect who conducted the restoration of St. George's

chapel. He published a magnificent treatise on the subject, and executed one portico and a few door-cases in and near Windsor.

Q. What are the peculiarities of this novel order?*

A. Mr. Emelyn says, "his order was first brought into his mind by the twin trees in Windsor forest? He makes an oval shaft rise one fourth of its height, and then two round shafts spring from it, close to each other; and the diminution affords space for two capitals, which have volutes, and, instead of leaves, feathers, like the cap of the Knights of the Garter. The entablature has triglyphs, and the cornice mutules. The triglyphs are ostrich feathers; the guttæ acorns; and the metopes are filled with the star of the Garter. To conceal the awkward junction of the two columns to the lower part, an ornament is placed there, which is a trophy, with the star of the Garter in the centre.

Q. What was the result of this attempt?

A. A decided failure; but nevertheless it is worthy of record. This species of order must be extremely unmanageable and difficult—indeed, almost impossible to make a good angle column. If its entablature be proportioned to the diameter of one column, it will be too small; if to the whole diameter, it will be too heavy; and a mean will give the capitals wrong—so that, in any shape, some error arises. In the portico above-mentioned, the entablature is so light as to appear preposterous.

THE DISTINGUISHING PRINCIPLES OF ENGLISH STYLES, AND GRECIAN AND ROMAN ORDERS.

Q. What are the striking contrasts of the English styles, and Grecian and Roman orders?

A. They are formed by those principles, in buildings of real purity, which will at once demonstrate the impossibility of a good mixture.

Q. Enumerate the comparisons?

A. *English.* 1. The general running lines are perpendicular.

2. Arches, a real fundamental principle; and no pure English building or ornament can be composed without them.

3. No such thing as entablature composed of parts; and what is called a cornice bears no real relation to the shafts which may be in the same building.

4. The shafts can only support an arched moulding, and in no case a horizontal line.

5. Nothing analogous to a pilaster; every flat ornamented projecting surface is either a series of panels or a buttress.

6. No horizontal line necessary; and never any but the small cap of a shaft.

7. Shaft bears nothing, and is only ornamental; and the round pier still a pier.

8. Buttresses essential parts, and stop all horizontal lines.

9. Pediment only an ornamented end wall, and may be almost of any pitch.

10. Openings almost unlimited.

11. Regularity of composition seldom found; and variety of ornament universal.

12. From its perpendicular lines may be carried to any practicable height, with almost increasing beauty.

Grecian and Roman. 1. The several running lines are horizontal.

2. Arches not necessary.

3. An entablature absolutely necessary, consisting always of two, and mostly of three distinct parts, having a close relation to, and its character and ornaments determined by, the columns.

4. The columns can support nothing but an entablature; and no arch can spring directly from the column.

5. A flat column may be called a pilaster; which can be used as a column.

6. The arch must spring from a horizontal line.

7. Columns, the supporters of the entablature.

8. No projections like buttresses; and all projections stopped by horizontal lines.

9. Arrangement of pediment fixed.

10. Openings limited by the proportion of the columns.

11. Regularity of composition on each side of a centre necessary.

12. Cannot form good steeples, because they must resemble unconnected buildings piled on each other.

NOTE.—Vanburg (1700) had a style of architecture peculiar to his own views—the Clarendon Printing Office, at Oxford, the buildings in the Gunwharf at Devonport, and other Government erections, pourtray such sombre appearance and massive construction, that the following lines are said to be inscribed on his monumental tablet:

"Lie heavy on him, earth, for he
Laid many a heavy load on thee."

It must be observed, in modern buildings, that, deviating from the prescriptive styles and orders just noticed, a species of *Italian architecture* is introduced in our villas and country residences, conspicuous by the several verandas round the dwellings, forming balconies, colonnades, &c. whilst the windows in some instances are hung with Venetian shades, giving a *tout-en-semble* appearance of neatness and pleasantness. Another mode of building is very appropriately designated *Rustic Architecture*, in which the roofs are thatched with straw or reeds, the trunks of unhewn elms or oaks supporting their projections, or forming porches, and the ivy, with the jessamine and the honey suckle, in their season, diffusing sweet odors around the delightful spot.

* This attempt is not generally known, as the book was very expensive, and the portico at a distance from the public road.

ANTIQUE AND MODERN EUROPEAN BUILDINGS.

Q. What are the principal works of the Grecians, extant; or whose ruins declare the mighty power of genius that reigned in that once astonishing empire?

A. The Parthenon, a temple at Athens, sacred to Minerva, destroyed by the Persians, and afterwards rebuilt by Pericles, in a more magnificent manner. It is an oblong parallelogram, adorned with a vestibule, a *pronaos* or portico, and raised upon three steps, all round; the interior was divided into two distinct naves, receiving all their light from the door; in one was the statue of Minerva, twenty-six cubits high, made of gold and ivory, the work of Phidias; in the other was the treasure of the Athenians. The columns of the vestibule and portico (fluted) rested on the steps of the temple, without bases, and were forty-two feet high, seven diameters and a half at bottom; intercolumniation, seven diameters and a quarter. The whole structure was two hundred and eighteen feet long, and ninety-eight feet and a half broad. The frieze was decorated with triglyphs and metopes of marble sculptured between, and the pediment grouped; the frieze of the *cella* was decorated in *basso relievo*. The building being of marble, with a brilliant sun shining on its walls and columns, produced a golden tint, and added to the glory of Grecian architectural specimens. The temples of Theseus, at Athens, and Jupiter Panhellenicus, at Ægina, are still extant in fallen ruins.

Q. Was Grecian architecture adopted in other countries?

A. Yes; in Sicily, and South of Italy. The magnificent ruins of the temple of Juno, at Agrigentum, the temples and porticos at Pæstum, south of Naples, the excavations of Pompeii, and the ruins of Palmyra, in the east of Syria, consisting of porticos, temples, and palaces, declare the mighty sway of Grecian art and Grecian prowess.

Q. What mementi have the Romans left the world of their great achievements in architecture?

A. Numerous: Rome, in her prosperity, having no less than four hundred and twenty temples, most of which were circular, crowned with domes, and crowded with statues. Amongst the most famous of temples were those of Romulus, Janus, Cybele, Vesta, Mars, the Sybils, Jupiter Tonans at the foot of the capitol, Vespasian's Temple of Peace, and that of Jupiter Stator, in the Forum. The Forums were several; but the Roman forum, the most renowned spot of the ancient city, exceeded all the rest in size, splendor, and architectural beauty; of the others, that of Trajan occupies a priority of rank, with Trajan's column in front; nor must be omitted, the Coliseum, Circus, and Amphitheatre, at Verona—the Amphitheatre at Pola (the front pillars being of the Corinthian order)—the Theatre of Marcellus—the Pantheon, built by Agrippa, A. D. 8, or 10, over whose immense area is thrown the pensile vault, and is now converted into a Christian temple—the triumphal arches of Severus, Titus, Constantine—the pillar of Antonius—finally, the tomb of Hadrian, now the castle of St. Angelo—the stupendous aqueducts—the noble bridges, fountains, catacombs, and obelisks—with superior specimens of tesselated pavement.*

Q. What have been the most remarkable buildings amongst the Christian nations?

A. Churches began to be erected in great splendor after Constantine made Christianity the religion of the Roman empire. St. Helena, the mother of Constantine, built many churches in Palestine.

Q. Which are the greatest productions?

A. Of Grecian art, the largest and most magnificent church is that of St. Sophia, or the church of Divine wisdom, at Constantinople, which is now used by the Turks as a mosque.

Q. Which is the most magnificent pile of architecture in the world?

A. The Church of St. Peter, at Rome; the area of whose floor contains about four times the space of St. Paul's, at London, being eight hundred and forty feet long, seven hundred and twenty-five feet broad, three hundred feet high, and two thousand four hundred and sixty-five feet in circumference. It took 150 years to build; and its splendor well accords with the enormous sum said to have been expended—£12,000,000.

Q. What other Romish church deserves particular attention?

A. The Cathedral Church of Milan, a building of great magnitude and beauty, of the pointed style, and adorned with 11,000 figures. The Milanese call this fabric the *Eighth Wonder of the World*. It is 500 feet long, 200 feet broad, and 400 feet high. At Milan also are several fine palaces, churches, convents, and schools.

Q. What are the antiquities of Spain?

A. They are principally of the Roman and Moorish; amongst which will be found

* Rome has, at present, (though only one fourth its former size,) three hundred towers, as many churches, twenty-eight gates, and six bridges over the Tiber. The Library of the Vatican, the Pope's Palaces, namely, the *Vatican*, a *Summer-house* on Mount *Cavallo*, and the Palaces of the Vatican near the church of St. John, where they crown the Popes, deserve particular notice.

the Cathedral of Seville, the Royal Palace (Alcazar) built by the Moors, also an aqueduct six miles in length. Burgos, the capital of Old Castile, is noted for its Cathedral —being one of the most magnificent religious fabrics in Europe. Salamanca boasts of its University, magnificent churches, and fine fountains; the Cathedral is of beautiful structure; over the river Tormes, passing through Salamanca, is a bridge, built by the Romans; near the city also are the remains of a *Roman Way*, paved with large flat stones—it was continued to Merida, and from thence to Seville. Badajoz is also famous for a Roman bridge, over the Guadiana; also Alcantura, for one over the Tajo, built by Trajan, the Roman emperor. Alcala stands high for its University, built by Ximenes. Near Segovia is a grand aqueduct, supposed to have been erected by Trajan: it extends over a deep valley, and is supported by a double row of one hundred and fifty-nine arches. At Toledo are the remains of an old Roman theatre, now converted into a church. It is six hundred feet broad, and of proportionable height: the roof is very bold and lofty, supported by three hundred and fifty pillars of the finest marble. Martorel has a lofty bridge, built in 1708, out of the ruins of an old one that had existed 1015 years from its erection by Hannibal: at the north end is a triumphal arch, almost entire, raised by Hannibal, in honor of his father, Hamilcar. The fortified palace of Alhambra, in Grenada, was built in 1280 by the second Moorish king of Grenada, and in the reign of the eighteenth king, in 1492, was taken by the Spaniards. The beautiful gate called Alcala, at the entrance of Madrid, together with the variety of steeples and spires, give this city great dignity of appearance. The Escurial, in New Castile, is esteemed the most costly palace in Europe.

Q. What are the edifices throughout France claiming notice?

A. In Paris are the Palaces (very superb buildings) of the Tuileries and Louvre, the Palais Royal, Palais Bourbon, or French House of Commons, Palace of the Luxemburg, or Chamber of Peers, Palais du Temple, Palais de Justice, and Palais de Thermes, (of Roman antiquity,) with numerous others. Hotel Royal des Invalids, Hotel de la Legion d'Honneur, Hotel des Gardes du Corps, with many more Hotels. The churches are those of Notre Dame, St. Genevieve, (or Pantheon,) and several of minor construction. Theatres, barracks, triumphal arches, as St. Denis, St. Martin, and L'Etoile, and Column in the Place Vendome, the Pont de Neuf, and piles of other buildings in and near Paris, partaking of different styles and orders, render this metropolis a second Rome. The Cathedral of Rouen is one of the most magnificent monuments of pointed architecture in the world: it was built under William the Conqueror's reign, and completed in 1063. Strasburg, near the Rhine, is noted for its lofty spire, the highest in Europe, being five hundred and seventy-four feet; that of Salisbury, in Wiltshire, four hundred and ten.

Q. What are the antiquities of Portugal?

A. Roman and Moorish. The Roman bridge and aqueduct at Coimbra are almost entire. The walls of Santarem are likewise of Roman origin. Near Braga are the remains of a temple, supposed to have been dedicated to Æsculapius. The remains of the Moorish Castle at Torres Vedras claim particular notice.

Q. What is to be advanced on the antiquities and buildings of Switzerland?

A. Basle, or Basil, possesses a beautiful cathedral. Lausanne has a fine church, in which is the Tomb of Amadeus VIII. Duke of Savoy. Here also is a University, founded in 1360. Lucerne is remarkable for its bridges, being covered at the top, and open in the sides, and decorated with coarse paintings; amongst which are the histories of the Old Testament, the battles of the Swiss, and the Dance of Death. St. Gallen has a rich and celebrated Abbey, in which were found, in 1413, several manuscripts of the classic writers, Petronius Arbiter, Valerius Flaccus, and Quintilian. In Switzerland are several hermitages of peculiar construction: the most curious is one six miles from Friburg, amongst woods and rocks; it consists of a chapel, an oratory, (a place for praying,) steeple, hall, kitchen, rooms, stairs, well, and other conveniences, all hewn out of a rock, even to the chimney and steeple; though the latter is 54 feet high—*the labor only of one man and a boy.*

Q. What other continental nations deserve notice for their several buildings?

A. Those of Germany deserve attention, particularly the churches at Hamburg; Berlin is considered one of the handsomest cities in Europe; Koningsburg has a large University, a magnificent palace, and a handsome library; Vienna is adorned with several splendid public edifices. The Stadthouse, Amsterdam, founded on piles, as also the city itself, extending over eighty-two islands, which communicate with each other by three hundred bridges; Rotterdam possesses fine buildings, in cathedrals, churches, &c.; Antwerp has beautiful churches, and a noble

exchange, from which Sir Thomas Gresham took the model of that in London; Leyden and Utrecht are noted for their Universities; the Hague, as the seat of Government, is greatly celebrated for the magnificence and beauty of its buildings; and Haarlem is remarkable for its cathedral, and the finest organ in Europe, consisting of eight thousand pipes—the largest is thirty eight feet long, and sixteen inches diameter; Ghent abounds in churches and monasteries; as also Liege, Luxemburg, and Bruges. Upsal, in Norway, is noted for its University. Moscow is a city of particular splendor; of which, it has been observed, "here are seen grouped together, spires glittering with gold amidst burnished domes and painted palaces, mixed with pagodas from China, mosques from Constantinople, Tartar temples from Bucharia, and cabarets from Spain." St. Petersburgh, with its imperial palaces and lofty towers, vies with the ancient city.

Q. What are the antiquities and buildings in England, claiming particular attention?

A. In London the most remarkable is St. Paul's, whose length within the walls is five hundred feet, and its height three hundred and forty feet. It is built of Portland stone, after the model of St. Peter's, at Rome; it is the principal work of Sir C. Wren, who finished the building thirty-seven years after he had laid the foundation stone, being begun in 1673 and finished in 1710. Westminster Abbey claims the next rank to St. Paul's, being a superior edifice of pointed architecture. Mention is made of this building as early as the year 850; it was rebuilt by Edgar, and again by Edward the Confessor. Westminster Hall is said to be the largest room in the world, being two hundred and thirty feet in length, and seventy-six in breadth: it has a beautiful pendant roof. The tower is of great antiquity, (supposed to have been built by William the Conqueror,) containing many curiosities, and subsequently the occasional residences of princes. The Guildhall claims attention, under whose roof the civic feast is well displayed. The Monument is a beautiful structure, two hundred and two feet high, and fifteen feet in diameter: it was built in 1671. The Royal Exchange, erected by Parliament, in 1669, after the one destroyed, built by Sir T. Gresham—the British Museum, containing many curiosities—Somerset House, built by the Duke of Somerset—the Mint—the Bank—the Coliseum—the Custom House—the Post Office—the Parliament House—the King's Palace—the Triumphal Arches at the western entrance of the city—the several bridges, namely, London, Westminster, Blackfriars, Waterloo, Southwark, and Vauxhall, (the two last built of iron); with which must be enumerated the several churches and chapels, both antique and modern—with modern terraces, crescents, villas, &c.; all claiming attention as adding a lustre to a British metropolis.

Q. What are the other buildings throughout England?

A. York Minster, the Cathedrals of Canterbury, Durham, Worcester, Lincoln, Exeter, Winchester, Gloucester, Norwich, Chester, Rochester, Wells, Litchfield, Salisbury—all partaking more or less, excepting the last, in the several repairs afforded, of the Saxon, the Norman, and the English styles of Architecture; nor must be omitted the two Universities of Oxford and Cambridge, whose Colleges and Halls vary in design from the Saxon, through successive ages down to the Grecian and Roman. Eton College stands high; as also Greenwich Hospital; but, above all, the princely residence of kings, Windsor Castle. The Pavilion at Brighton is splendid, though peculiar. In our principal towns, as Liverpool, Bath, Bristol, &c. and the lordly domains throughout the country, are great displays of superior modern architecture.

Q. What are the antiquities of Great Britain?

A. Of British antiquities, Stonehenge, in Wiltshire, is the chief, consisting of two circular and two oval ranges of rough stones, having one common centre; the circle is one hundred and eight feet diameter. Many of these Druidical temples are to be found round about the country, particularly in Wales, called by the inhabitants Cromlechen. Roman and British camps, walls, castles, &c. abound here. Of Roman, the Picts' Wall claims priority; it began at the entrance of Solway Frith, in Cumberland, running by Carlisle, and Newcastle, and ended at Tynemouth. It was first built of earth by the Emperor Adrian, in 123, and afterwards of stone, by the Emperor Severus; Ætius, a Roman general, rebuilt it of bricks in 430. It was eight feet thick, twelve feet high, and about one hundred miles in length. Next are the *military ways*—their vestiges are numerous in the kingdom. One of these ways extended from Dover to London, from thence through Verulam, &c. to near Shrewsbury, and thence through the middle of Wales to Cardigan. The *Herman street*, or *Great Military Way*, passed from London through Lincoln, &c., the *causeway* of which is perfect in many places, although finished nearly one thousand six hundred years since. Of Saxon, Danish, and Norman antiquities,

they consist principally in cathedrals, castles (Rochester,) and various camps.

Q. What are the claims of Scotland in antiquities and buildings?

A. Edinburgh, the capital, is peculiar in its buildings, remarkable for the loftiness of its houses, inhabited on different floors by distinct families; it contains the Palace of Holyrood, the Castle, and several elegant churches and buildings. Edinburgh, Glasgow, St. Andrews, and Aberdeen, are noted for their Universities. Granite, free-stone, lime-stone, marble, and slate, being found in Scotland in great abundance, contribute to the grandeur of the several buildings.

Q. What is to be advanced about Ireland?

A. Dublin, its metropolis, is characterised for fine specimens of architecture in its Post Office, University, Theatre, and other buildings, and ranks as the second city in the British dominions.

PRACTICAL ARCHITECTURE.

Q. Whence is the word architect derived?

A. From the Greek word *arche*, chief, and *teucho*, to form—in the Latin, rendered *architectus*,—both equally significant; it implies the principal deviser, contriver, or inventor of any thing. Hence, "Deus regnator architectus omnibus"—ascribing the appellation to the Deity itself.

Q. What is architecture, then?

A. It is the production of power, of might, of skill—displaying the co-operation of mental energy and physical power, founded on the nicest mathematical principles.

Q. What are these principles?

A. Order, disposition, and proportion, established on the grand basis of *solidity*.

Q. What is implied by solidity?

A. Strength, firmness, massiveness—in opposition to superficials. Thus, when Cicero says, "atomorum soliditas," defines, that there may be even solidity in an atom.

Q. Where is solidity sought?

A. For the *foundations of all superstructures*.

Q. How are foundations considered?

A. The earth producing different soils and strata, foundations become natural or artificial.

Q. What are natural foundations?

A. Where the ground is good or rocky, as on the western shores of England.

Q. What are artificial foundations?

A. When, from the boggy or sandy state, piling, arching, or some other precaution, must be resorted to, before the fabric can be reared.

Q. What is the first essay to be made for building?

A. The knowledge of the properties of the ground, by boring; should it shake on being struck with the rammer, excavation may be commenced, widening at the top; and instead of inclined sides, it is preferable to cut steps, by which means a firmer bed will be obtained for the wall.

Q. What directions for foundations does Palladio recommend?

A. That the ground be dug to one sixth part of the whole height of the building, unless there be cellars, when he recommends going deeper. This, however, the practitioner can appreciate; but it is a good rule to make the foundation double the breadth intended for the superincumbent wall; and the contraction of it should be made alike on both sides. The foundations of St. Paul's and the Monument are extremely deep.

Q. When the ground is found defective in one place, and good in another, to prevent an unequal settlement of the building what method is resorted to?

A. The use of arches, either inverted or suspended, according to circumstances.

Q. When are inverted arches used?

A. When the soft parts of the ground are under the apertures only.

Q. Of what advantage is this method?

A. That one continued base is obtained; for the piers cannot sink without carrying the arches, and consequently the ground upon which they stand along with them. The whole building will therefore sink equally, and no fracture of the walls ensue. Inverted arches are frequently used, even on good foundations; they are particularly applicable to small bridges over canals, in indifferent ground, and should be thrown with the greatest care, closely jointed, and their depth equal to half their width.

Q. When are suspended arches used?

A. On the reverse of the preceding occurring: *i. e.* when solid foundations are only to be found under apertures, then piers must be built in their places, and arches suspended between them.

Q. What is the determination on this point?

A. That it is best to make the middle of the pier rest upon the middle of the summit of the arches. If the pier do not cover the arch, the narrower it is the greater should be the curvature of the latter at the apex. When arches are used in this way, the *intrados* ought to be clear, that they may have their full effect. The uniform resistance of the ground upon which the piers are erected is also of greater importance than even its perfect hardness; for, if it resist uniformly, the building will sink in every part alike, and remain uninjured: this custom is adopted where the wall is carried to

a great height, and the levels filled up, as exemplified in the boundary walls of the House of Correction, Clerkenwell, London.

Q. What is the importance consequent on the foundations and abutments of bridges?

A. The foundations and abutments have not merely the superstructure to bear, but the flux and re-flux of tides to oppose, and the test of ages, with all their concomitants, upon the materials used, to endure.

Q. What does Palladio observe on bridges?

A. "To make bridges lasting, the goodness of the ground is one of the most important things to be attended to. Bridges ought always to be constructed at right angles with the current—the piers so proportioned as to enable them to withstand the thrust of the adjoining arches, though the rest were thrown down; yet to fall short of the size required for this purpose, would hardly be a greater fault than materially to exceed it; for when the piers are unnecessarily larger, the current, being contracted, increases its velocity, and is apt to undermine the foundation."

Q. How are the foundations of the piers of bridges effected?

A. By a *caisson*, an immense vessel of peculiar construction, which is sunken where the foundations are determined, and being hollow, the water is pumped out and the work begun—or by driving piles closely together, forming a *coffer dam*, secured by cross pieces, braces, bolts, &c.; it is then caulked or clayed as the water recedes, and the remainder is pumped out.

Q. What are the preparatory measures adopted for the foundations?

A. Dry straight-grained piles of elm or beech of certain lengths, shoed and capped with iron, are driven by engines constructed for the purpose. When this area of piles is completed, with as even surface as possible, *sleepers* of the same wood are spiked to their heads: three, four, or five courses of good bricks, bedded in a composition of lime, pozzolona, and clean sand, are then laid, and upon this work the stones of the intended superstructure are placed. Hence the artificial foundations of bridges. Of such foundations also are the dry docks of His Majesty's yards—of dock-walls, contiguous to the river, particularly the external wall to the basin, and the basin itself, at Sheerness Yard. Nor must be forgotten the Stadthouse, or palace, in the Netherlands, founded upon piles, at a most enormous expense.

Q. What foundation particularly claims attention?

A. It is that of the Eddystone Light-house—being natural: the base of this solitary pile, which consists of solid stones, is united to the surface of the rock by dove-tailing and cramping; which surface, being inclined, is cut away—forming steps for the preceding purpose. The building is carried up (nearly solid) to a great height, having merely a well to communicate to the upper chambers, whose stone floors are arched, and meet the pressure of the exterior walls. Chains are let into the several stones, and leaded. The whole of the work is executed with the nicest precision, and stands, amidst the tempest's rage, a master-piece of art. The Rock Light-house, off Ireland, is built upon similar construction.

Q. What gigantic mole rises to the furies of the Atlantic?

A. The Breakwater, at Plymouth; this mole extends itself across the Sound, from east to west, nearly a mile—the extreme ends running obtusely from the inner parallel line to a certain extent: it consists of some thousands of tons of marble blocks, varying from five to fifteen tons, brought from the neighboring quarries by vessels, and deposited in line, forming a wide bed at the bottom, diminishng at the top to high-water mark. The surface of this extraordinary foundation is neatly laid with the blocks, forming a pavement. It is proposed on this mole to erect two light-houses—one at each extremity. The object of the breakwater, as its name imports, is to break off the fury of the sea, and afford good anchorage and shelter to shipping.

Q. What is to be said of the sub-marine foundation of the Tunnel under the Thames?

A. This, perhaps, is one of the most extraordinary attempts in history: from a shaft sunk in the Rotherhithe side, half the work is accomplished in a direct line under the Thames. The figure of the tunnel is an ellipsis, with a division wall in the centre, concentrating the figure into two ellipses, affording passages for ingress and egress. The whole is executed in brick-work of six or seven courses in thickness. The work was carried on by a machine which was moved progressively forward with the masons and excavators, as the excavation proceeded.

Q. Is there any other description of tunnels?

A. Yes, several; a fine specimen of tunnelling is to be found in the Thames and Medway Tunnel, extending two miles and a half in length, uniting these rivers. This tunnel is excavated under a range of chalk hills; the arch is pointed, the crowns of the extremities being only secured with brick about three hundred yards in, the natural qualities of the chalk requiring no continuation of brick arching, excepting where the shafts are introduced. Barges constantly

past to and fro, in five feet water—with a horse-path on one side. The base of the tunnel is square, on solid chalk.

Q. What are aqueducts?

A. Artificial channels of water, connecting canals together, over a valley, or even over rivers. They are constructed upon the principles of bridge building, having piers and arches to support the column of water passing over; stout breast-work is carried up on either side, as the parapet of a bridge, leaving a path-way on one side. There are several in England, but of no great moment.

NOTE.—This description of the several foundations appears more properly to belong to the branch of Civil Engineering; but in many instances the duties of Engineers and Architects run into each other, and become so reciprocal, that it is quite admissible.

T. Ewbank's Hydrostatic Safety Valve and Gauge, for Steam Boilers. [Communicated by the Inventor.]

SIR,—In accordance with your request, I forward a brief description of the Hydrostatic Safety Valve, promising that a more perfect account of it may be seen in the "Journal of the Franklin Institute" for January and July of last year, (vols. 9 and 10.)

There appears to be a prevailing though erroneous opinion, that steam boilers are seldom, if ever, exploded by an excessive pressure of steam. Numerous persons suppose these disasters to be *invariably* owing to a deficiency of water within them at the time; hence they consider all improvements in the safety valve, or the application of other devices for a similar purpose, as having a tendency to increase the risk of explosion, by promoting negligence in the attendants. It is sufficient to observe, in answer to reasoning of this description, that it is equally calculated to prevent all improvements whatever in the steam engine. Had such arguments been listened to 120 years ago, this noble prime mover of the arts might still have been confined to its original purpose of raising water; and each one attended by a person, upon whose attention in alternately opening and closing the valves, the continuance of its motion depended. Such objections were particularly calculated to prevent the introduction of the important improvement of Potter, who, it is said, had a disposition to skulk, or "*scog*," (as it was there termed,) which led him to devise a simple contrivance, which changed the whole character of the steam engine—for by it the engine no longer depended upon an attendant for the continuance of its motion, but became in a manner self-acting, and with a regularity infinitely superior to its previous movements. His device he called a "scogger."

Explosions of steam boilers are not attributable to one cause: there are several. A deficiency of water is a fruitful one; excessive pressure of steam is another; a third may be found in the defective construction of a boiler; and where several are connected together, their not being heated *uniformly* is another. Numerous examples of each of these might readily be furnished. I believe there are not wanting instances where the attending engineers have been blamed, when the real cause was to be found in one or both of those last mentioned.

The importance of the safety valve is universally understood; without it no boiler could ever be secure. Upon it depends the very existence of the steam engine; for without the safety valve, as Mr. Galloway justly observes, "steam would long ere this, have been abandoned as a most dangerous and ungovernable agent." Every person can readily perceive, that however strong a boiler may be, if the force within it be not limited it must be rent asunder; hence the design of safety valves, which are intended to open, and discharge the excess of vapor, whenever its elastic force exceeds the prescribed limits. In the case of a steamboat, the lives of the passengers and safety of the boat depend in a great measure upon the right construction and proper use of this part of the steam engine.

One of its most essential attributes consists in its being properly loaded; and a provision to prevent this load from being increased. By the arrangement of the ordinary valve, it is difficult, if not impossible, to accomplish this; the load may be increased indefinitely, either by augmenting the weight directly on the lever, or by moving it further from the fulcrum: how frequently and fatally this has been done, may be abundantly seen in the history of explosions. There are also other defects in the ordinary valve, though less obvious to common observers, such as the indirect mode of obtaining the pressure upon it, through the intervention of the lever and its joints, by which the centre of pressure, instead of being directly on the centre of the valve, becomes more or less on one side, which prevents it from being raised perpendicularly, and causes it to adhere to its seat. The friction of the stuffing-box, through which the valve rod passes, and also that of the joints, both of it and the lever, which from rust, &c. is often considerable. These and other defects are so great, that were it not for the mercurial gauges used with low pressure

boilers, (and they are inapplicable to those of high pressure,) no accurate knowledge of the pressure of steam could be ascertained by safety valves as ordinarily used.

These defects are supposed to be entirely avoided in the valve now submitted to your examination.

Its position is the reverse of the ordinary one; that is, instead of opening upwards, it is made to open downwards. For this purpose it is raised above the boiler, and connected to it by a pipe. By this arrangement you will perceive that the pressure requisite to keep the valve closed must be exerted in an upward direction. To attain this, and at the same time *limit* the pressure, a simple device is adopted, which will be understood by supposing an empty vessel (a bucket, for example,) placed with its bottom down, into water, or any other fluid; if depressed in that position, the power required to do so will be in proportion to the area of its bottom and the depth of its immersion; but if forced down till its upper edge becomes level with the surface of the fluid, the power required to keep it there, or in other words, the force which the vessel exerts in a contrary direction, will then be at its maximum; for if further depressed, the fluid would run into and sink it, and destroy its buoyancy altogether.

Suppose the vessel containing the water, which is rather larger in diameter, but of less depth, than the bucket, (that the fluid may never be permitted to run into the latter,) be placed immediately under the safety valve, and firmly secured to that part of it containing the seat of the valve. Let the bucket be placed in it in the position as before; and a rod, extending from the centre of its bottom to the centre of the valve; then, if the outer vessel be filled with water, the force tending to raise the bucket against the valve, by means of the rod, will be as before mentioned, at its maximum; nor can it be increased: consequently, the elastic force of the steam in the boiler can never rise higher than what is equivalent to overcome this pressure.

The length of the rod is such as to admit a space of two or more inches between the bottoms of the two vessels, in order to allow the valve to open that distance.

The foregoing is a brief description of the *principle* adopted in this valve; and which may be more clearly understood by the annexed cuts:

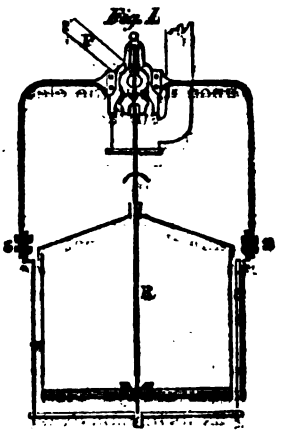


Fig. 1 represents this valve in section with the vessels by which the hydrostatic pressure is made. The outer one is enlarged at the top by a rim, from which a pipe descends, which prevents any surplus fluid from flowing over it or entering the inner one. It is firmly secured to the inverted valve seat by the rectangular rods which are bolted to the rim at S S. V is the valve, kept up against its seat by the rod R, the upper end of which enters a countersunk hole in it; and the lower end in a similar cavity in the centre of the bottom of the vessel. The rod being tapered at its ends, presses only on its central points. The inner or floating vessel is furnished with a cover, to prevent condensed steam from falling into it when the valve is opened. The rod passes through the centre of this cover, a few inches above which an inverted cup is soldered to the rod to cover the opening. A short tube, with a branch attached to it, is connected to the under part of the valve seat, to take off the waste steam when blowing off. The communication between the valve and the steam in the boiler is by means of the pipe P, which may either be connected to the boiler or the steam pipe.

To prevent any friction arising from the inner or floating vessel touching the sides of the other, a short rod is attached to the centre of its bottom on the under side, which enters a corresponding cavity drilled into the bottom of the other.

This apparatus, unlike the ordinary safety valve, combines in itself both the valve and gauge, with its tell-tale ; and this gauge is applicable to steam of *every degree of elastic force.*

Fig. 2. is an exterior view, and which also shows the gauge ; which is a glass tube connected to the cock at the bottom of the outer vessel, and communicating with the water in it. It is open at top, and protected by a metallic case with a slit its whole length, to allow the height of the water to be seen. This case is graduated, so that when it is wished to ascertain the strength of steam, the cock is opened, and the water allowed to subside until the steam begins to open the valve, when the mark on the case, opposite the surface of the fluid in the tube, indicates the pressure ; and this it will do to the fraction of an ounce.

In this valve there is no friction to be overcome. No lever, stuffing box, weight, bolts or joints, to obstruct its operation. *It cannot be overloaded.* The common valve is very liable to adhere to its seat, when not frequently moved, by the accumulation of saline or other matter upon it, but the elevation of this valve above the surface of the boiler, and its inverted position, prevents this from taking place. Moreover, a portion of condensed steam constantly collects above it, and occasionally oozes out, thus cleansing the surface and preventing the formation of any matter upon it whatever. One has been attached to a high-pressure boiler in this city for three years ; and not an hour's labor has been expended upon it during that time ; nor has it once ceased to operate with perfect accuracy—the steam always blowing off as soon and as long as its tension exceeded the prescribed limits.

It is respectfully submitted to owners and captains of steamboats, whether the adoption of this valve would not prevent explosions that arise from *one* acknowledged source—an excess of steam : and at the same time put to silence the complaint of the public on that subject. Very respectfully,

THOS. EWBANK.

P. S.—One of them is at Mr. Worrall's Foundry, Elm Street, New-York.

GLASS TILES.—M. Dorlodot, a glass manufacturer, at Anzin, in France, has invented a species of glass tile, of great solidity and transparency, which, it is thought, may be substituted with much advantage in all cases where skylights are now employed. The existing excise laws of Great Britain oppose, however, an insuperable bar to their adoption in this country, unless under circumstances where expense is no object.

MACHINE FOR EXCAVATING EARTH.—Mr. G. V. Palmer, of Worcester, has been ten years and upwards engaged in constructing an extraordinary engine to excavate earth, &c. for which he has taken out a patent. This engine works by steam, and is particularly adapted for cutting canals, levelling hills for railways, and removing large masses of earth. The engine cuts, at a single blow, six feet in width and three feet in depth—delivering on either side, or into carts, one ton and upwards per minute : it also cuts and sifts gravel in the same proportion for road-making. We understand it is of great simplicity of construction, and the weight of the engine does not exceed three tons.—[Manchester Courier.]

MACHINE FOR MAKING BRICKS.—Messrs. Harkness, Sawyer, and Freelove, have now in successful operation a machine which has excited the admiraton of all who have witnessed its operation. It produces twenty bricks in a minute, and these too, not the unshapely and rough masses of mud, which we usually call bricks, but a square and smooth body of clay, so hard, when they leave the press, that they are fit to set immediately into the kiln for burning.

The moulds (four in number) in which they are pressed are made of polished steel plates—which plates are set in a cast iron box ; and the whole banded with strong wrought iron bands. The machinery is so constructed that the mould is fixed in a solid stationary frame ; and after the pressure is made upon the clay in the mould, the bottom of the mould rises, and throws the brick to the top, so that it may be conveniently taken off. It is found by experience, that not less than 50 tons pressure upon each brick will answer the purpose. This amount of pressure is, of course, wanted only at the very *last* moment of the impression ; or, in other words, can be pressed with very little effort into a space within, say, one-fourth of an inch of the proper thickness. After it is thus far pressed, it then requires at least 50 tons to bring it to a proper degree of density. The machine in question is so constructed as to give this great pressure at the *time it is wanted*, and no other. In fact, it would be difficult to find, in all the mechanical operations now in use, a more perfect adaptation of the *means* to the *end*. And it is thought by many scientific gentlemen, who have examined the matter, that *no other* application of the mechanical powers will ever be made to effect the same object.

It is only necessary that the utility of this machine should be known, in order to introduce it into general use. The beauty and durability which it will impart to the brick buildings of the country must make it an object of great pub-

lic interest. Add to this, the reduction of expense which must ultimately follow, and I cannot but regard the improvement of the gentlemen above named as of equal importance to any which has been introduced for the last 20 years.

The following *practical* statement, which has been obtained from the patentees, will no doubt interest such of your readers as are engaged, or may feel disposed to engage, in brick making.

A brick press can be put in operation for about $6.

The expense of carrying on the business for a month is as follows:

1st.	6 hands at $10 per month, - -	$60.00
	Boarding same at $1.25 per week, -	30.00
2d.	3 boys at $6 per month - -	18.00
3d.	2 horses at $7.50 per month, - -	15.00
4th.	60 cords of wood at 90 cts. per cord,	54.00
	The setting and burning of 180,000 bricks, at 40 cts. per 1,000, - -	72.00
		$249.00

The above are the regular expenses per month of carrying on a horse-power press. The press, when in operation, makes 20 bricks in a minute, or 9,600 in 8 hours. Deducting, however, for loss of time and other contingencies, 1-4th for every day's work, leaves the amount of 7,500 bricks per day, or 180,000 per month; which, at $3.50 per 1,000, are worth $630. Deduct the expense of making, which is $249, and there remains a clear profit to the owner of $381 per month; or, $1,905 for five months, the time that could be conveniently occupied each season in brick making.

The above estimate is based upon the price of brick, of labor, and of boarding, at Mount Vernon. In many places, labor and boarding would doubtless be more expensive. But in such places, the price of brick would probably be increased in proportion.—X. Y. Mount Vernon, May 15, 1834.—[Ohio State Journal.]

Statistical Facts in relation to the Chesapeake and Ohio Canal. To the Editor of the American Railroad Journal.

WASHINGTON, April 11, 1834.

SIR,—The following statistical facts, in relation to the Chesapeake and Ohio Canal, I have collected from the mass of documents which have been printed by Congress and the Company, and which amount in bulk to several octavo volumes. I have not, either, all of their reports to refer to, as the price of an entire copy of the proceedings of the board of directors and engineers costs now $20 to $25, and many of the papers are very scarce. Such as are given below will, I hope, answer your purpose. Alter them and change them as may best suit your views.

The general convention of Delegates from Pennsylvania, Maryland, Virginia, the District of Columbia, and one or two of the Western States interested, first met at Washington, D. C., in November, 1823, to determine on the proper measures to be adopted in reference to the successful prosecution of this great work of internal improvement. The first charter was granted by Virginia, in January, 1824, which was confirmed by Maryland in January, 1825, and by Congress in March of the same year. Pennsylvania granted her charter with some restrictions, (relative to portions of the appropriations of Congress being applied to the construction of the western section, &c.) in February, 1826. All four of these legislative bodies have since passed various acts, extending and restricting the powers of the Company.

SUBSCRIPTIONS.—Books were opened in 1826, after the confirmation of the charter by the several states.

Private subscriptions, - - -	$610,000
By Maryland, in March, 1826, -	500,000

Maryland, in 1834, granted $50,000 additional: $25,000 cash, and the remainder when a further subscription was made by Congress.

By Virginia, in 1833, - - - -	250,000

Virginia had subscribed, in 1826, her interest in the Potomac Canal Company, which was then valued at 2 or $300,000.

By Corporation of Washington, -	1,000,000
By Corporation of Alexandria, -	250,000
By Corporation of Georgetown, -	250,000
By Congress, - - - - -	1,000,000

The cost, as estimated by the U. S. Engineers on the first surveys, was $22,375,427.69; and, by Geddes and Roberts, the company's engineers, since that time, was $9,347,408.69.

The projected route, (and in its location, thus far, it has deviated very little from the line originally laid out,) was up the valley of the Potomac river, as far as Cumberland; thence it follows the valley of Wills' creek, as far up as the mouth of Bowman's run, from which place it is to cross the summit ridge by a tunnel, railway, or inclined planes, as the company may see fit, the privilege of selecting being granted by their charter. (It is most probable that the company will adopt a railway with stationary power, as it will in the end prove the cheapest and most convenient.) The western course is thence down Castleman's river and the Youghagany, and the Monongahela, to Pittsburg. (It is doubtful, I think, whether this line, the western section, will be adopted, as the United States have been projecting improvements on the Monongahela river, so as to render it navigable as far as Brownsville, 55 miles by the course of the river above Pittsburg, and it will be shorter and more convenient to end at Brownsville than its present projected termination.) The total length of this projected route is 341 miles 676 yards, and is divided into the eastern, the middle or mountain, and the western sections, the former extending from Georgetown to Cumberland, 185 miles 1078 yards; the middle section, thence to the mouth of Castleman's river, 70 miles 1,010 yards; and the latter thence to Pittsburg, 85 miles 348 yards.

DIMENSIONS OF THE CANAL.—The size of the Erie canal was at first adopted as sufficient for the Chesapeake and Ohio Canal.

this idea was soon abandoned, and the following size determined on: 60 feet wide at surface, 42 feet at bottom, and 6 feet deep, giving a cross section of 366 feet. But for the purpose of giving sufficient water for manufacturing purposes, the first two miles above Georgetown were widened to 70 feet, with a depth of 7 feet, and the succeeding two miles have a width of 80 feet, and 7 feet depth. Between Harper's Ferry and the Point of Rocks, in some few places, and for short distances, it has been narrowed to 50 feet, and above Harper's Ferry it has been widened to 90, 100, 120, and even 150 feet, in several places. The locks are 100 feet long by 15 wide, in the chamber, and 6 feet deep. The tow paths are 12 feet wide, and the berm bank 8 feet. All the culverts, aqueducts, and locks, are built of solid stone masonry, laid in hydraulic lime. Many of the locks are so constructed, by lengthening the side culverts and multiplying their outlets, as to be filled in one half the usual time.

In November, 1830, the sections extending from the Seneca feeder to the termination of the old canal, around the Little Falls of the Potomac, (a distance of 17 miles and 774 yards,) were finished and opened for use. The sections in Georgetown were finished in August, 1831. The sections from the Seneca feeder to the Point of Rocks, (a distance of 26 miles and 363 yards,) were open for use in the spring of 1832, and by the end of 1833 it was completed as far as Shepherdstown, (72½ miles from Rock Creek Basin, Georgetown.)

Between the Georgetown Basin and the Point of Rocks, a distance of 48 miles 118 yards, is a rise of 217 feet, overcome by 27 locks: for the lift and distribution of which see table given below. Between the Point of Rocks and Williamsport, (to which the canal will be open from Shepherdstown this spring or summer,) a distance of 66 miles and 762 yards, is a rise of 136 feet, overcome by 17 locks: see table.

No. of lock.	Lift.	Construction.	Distance from lock to lock. m.	Distance from lock to lock. yds.	Total distance frm tide lock. m.	Total distance frm tide lock. yds.	Remarks.
Tide l.	8 l. wat.						
No. 1	8 ft.	Cut stone. Free stone.					
2	8	Same as tide lock.		661		601	In the locks of 8 feet lift, there are about 1,084 perches of masonry; each 4,426 superficial feet of ashlar (excluding coping and hollow quoins); 436 lineal feet of coping, 1 foot thick by 3 feet wide, making 4 feet of cut work for every foot lineal; and 61⅔ feet rise of hollow quoins: where the cut stone are exactly of the size required by the specifications, there are 384 perches of cut stone and 700 perches of backing. The quantity of cement for each lock of 8 feet lift, has varied from 3,000 to 3,300 bushels.
3	8	Same.		81½		742½	
4	8	Same.		100½		843	
5	8	Same.		98		941	
6	8	Partly of hammered and partly of cut stone.	4	909	5	90	
7	8	Same. Free stone.		637	5	727	
8	8	Cut, granite, and free stone.	1	1075	7	42	
9	8	Red sand stone. Cut	1	594	8	636	
10	8	Granite and free stone. Cut		604	8	1240	
11	8	Cut stone. Granite.		153	8	1393	
12	8	Cut. Red sand stone.		319	8	1712	
13	8	Cut stone. Granite.		545	9	497	
14	8	Same.		148	9	645	
15	8	Granite. Cut.		148	9	793	
16	8	Red sand stone. Cut.	3	1740	13	773	
17	8	Same.		311	13	1084	
18	8	Same.		618	13	1702	
19	8	Same.		178	14	120	
20	8	Same.		134	14	252	
21	8	Same.		198	14	452	
22	8	Same.	2	623	16	1075	
23	7	Same.	2	1544	19	859	
24	8	Same.	2	856	21	1715	
25	8	Same.		1174	22	1129	The masonry of lock No. 24 is connected with the lower abutment of the Seneca aqueduct.
26	8	Same.	8	23	30	1152	
27	8	Same.	8	1137	39	529	
		Same.	2	20	41	549	From lock No. 27 to the Monocacy aqueduct is 1,156 yards—the aqueduct, 172 yards long—thence to the Pivot bridge at the Point of Rocks is 6 miles 1 yard.
28	6	Granite transported on Balt. & O. Railroad, and flint (hard white) stone from neighborhood. Cut stone.		1337	48	1415	
29	7	Balt. granite. & hard white flint. Cut.	1	1597	50	1292	
30	8	Patapsco granite 1-7 & red sand stone. Cut.	4	143	54	1435	
31	8	Granite and flint from neighborhood.	3	121	57	1556	The foot of lock No. 33 is connected with the abutment of the bridge over the Potomac at Harper's Ferry.
32	9	Granite & lime stone from neighborh. Cut.	2	332	60	128	
33	8	Lime stone. Cut work.		760	60	888	
34	8	Same.		1556	61	684	The cost of lock No. 35, as well as that of 36, 37, 38, 39, 40, 43 and 44, (8 in number,) was at the rate of $1,120 per foot lift. This was including gates and foundations.
35	8	Same.		1267	62	191	
36	8	Same.		173	62	364	
37	9	Same.	4	909	66	1273	
38	5	Same.	5	1426	72	999	
39	6	Same.	1	297	73	1226	The two locks, Nos. 41 and 42, are constructed of Lawrence dressed lime stone; were built for $800 per foot lift, including gates and foundations.
40	9	Same.	6	447	85	940	
41	10	Hammered stone Lime stone.	6	1740	92	920	
42	9	Same.		200	92	1120	
43	9	Lime stone. 3 miles transported. Cut stone.		200	92	1320	Total lockage, 353 feet, from the Georgetown basin.
44	10	Same.	6	1020	99	580	

Besides the above 44 lift locks, a communication with the river Potomac is to be effected through the guard locks at the entrance of the feeders from the Potomac, and also through the two lift locks designed for the Virginia trade, and constructed in compliance with the Virginia charter. Four of these locks are required to be constructed similar in size and construction to the other lift locks of the canal, viz.: one opposite the mouth of Goose creek, which enters the Potomac, opposite the foot of lock No. 25; another at the Point of Rocks; two

ther opposite Shepherdstown; and the 4th, near the mouth of Opequon. The latter has since, however, been dispensed with, as its purposes are subserved by the transfer of locks Nos. 41 and 42, (which were located 2 miles above the mouth of Opequon,) to 2 miles below the mouth of that river. This transfer reduced the slack water navigation, between guard lock No. 3 and lift lock No. 41, from 7 to 3 miles, and increased the expense $100,000. There is also a lift lock in addition to the above constructed, connecting with the Potomac opposite the junction of the Shenandoah with the Potomac at Harper's Ferry, 627 yards above lock No 32. It has 10 feet lift, and is, in other respects, similar to the other locks.

Culverts.—Below the Point of Rocks there are, inclusive of roadways, 59 culverts, of which the total cost was $110,000. Three of these culverts are of 12 feet span each, 2 of 16 feet span each, (one over the Tuscarora, 2 miles above the Monocacy aqueduct, and the other 1 mile below the Point of Rocks,) and 1 of 2 arches of 16 feet span each over the Little Monocacy river: the total number of perches of masonry in these 59 culverts amounts to ——, costing $51,372—32 culverts, nearest Point of Rocks, 11,357, $50,000. Between the Point of Rocks and Harper's Ferry the number of culverts is 19, containing in all 6,839 perches of masonry, and the total span of which was 158 feet. There are, also, above Harper's Ferry, 41 culverts, the estimated price of which was $44,300. The culverts below Harper's Ferry are generally 110 feet long; while above, owing to the contraction in the width of the canal, they do not exceed 100 feet.

Aqueducts.—No. 1. Seneca aqueduct, built of red sand stone from the immediate neighborhood, is 114 feet long between the abutments, which, with the 2 piers, rest on a solid foundation. There are 3 arches of 33 feet each. Cost $62,784.

Aqueduct No. 2. Monocacy aqueduct, built of a white granite stone, (obtained within 3 miles of the site of the aqueduct,) is 438 feet in length between the abutments, and is 516 feet from end to end of the wing walls which project from them. There are 7 arches of 54 feet span each, and 9 feet rise, (segments of circles,) the radius of intrados of which is 45 feet. It contains 9,788 perches of masonry, (exclusive of the rough walls in which the cut masonry of the wings terminates.) Cost, $125,000.

Aqueduct No. 3 crosses the Catoclin, a tributary to the Potomac; it has 3 arches, 2 semi-circular, of 20 feet span each, and the third a semi-ellipse of 40 feet span and 10 feet rise, supported on piers, 6 feet wide by 33 feet long, while the parts under water (7 ft. in depth,) are 8 by 85, founded on solid rock. Cost, $33,500.

Aqueduct No. 4 is over the Antietam, a branch of the Potomac, entering 3 miles above the Government dam above Harper's Ferry. The abutments are 9 feet thick, and 108 feet apart. It has 3 semi-elliptical arches, 2 of 28 feet span, and the 3d of 40 feet span, with a rise of 10 feet each. The foundations of the piers and abutments are on solid rock. Greater portions of them are of cut stone masonry and expensively built. Lime stone from the neighborhood used. The towing path parapet is 7 feet thick at bottom and 6 at top. The berm parapet is 5 feet thick at bottom, and 4 at top. Width of track is 28 feet at bottom and 22 at top. Cost, $22,850.

Aqueduct No. 5 is over the Conococheague, which enters the Potomac at Williamsport. It has 3 arches of 60 feet span each; two piers and two abutments. The piers are 12 feet thick at the base. The arches are 32 feet wide and 15 feet rise. Tow-path parapet, 7 feet thick at bottom, 6½ at top; berm parapet, 5 feet thick at bottom, 4½ at top. The walls are raised 7 feet above the bottom of the canal. Estimated cost, $40,260. Not quite finished in December last.

Feeders.—No. 1. The Little Falls feeder supplies 4¾ miles of canal. An arched stone dam is thrown across the Potomac, and the admission of water into the canal is regulated by a single guard gate, and enters at the foot of lock No. 5. Length of the dam, 1750 feet, height 4 feet. Cost ——. The feeder is a part of the old canal around the Little Falls, constructed previous to 1800.

No. 2. The Seneca feeder supplies 17 miles, although at the foot of lock No. 18, at the Great Falls, an additional supply is received from the Potomac, through a small arch under the towing path. The dam across the Potomac for this feeder is — feet high, and 25,000 feet in length, and cost ——. The water is admitted into the canal through guard lock No. 1. The dam is of stone and arched.

No. 3. The canal for the next 40 miles depends almost entirely for water on the supply it receives from the Potomac at the head of Harper's Ferry Falls. The dam constructed by the Government for the use of the United States armory at Harper's Ferry answers all necessary purposes here, and no more water is drawn off than was formerly used by the old canal, which has been closed since the opening of the main canal. (A small feeder from the Tuscarora, which enters the canal 17 miles below the head of Harper's Ferry Falls, also assists towards supplying this section.) The water from the Harper's Ferry feeder is admitted through guard lock No. 2, situated near lift lock No. 35. This dam is — feet high, and — feet long. Cost of company's works here ——.

No. 4 supplies 23½ miles of canal. The dam across the Potomac is near ————, and is 20 feet high, and 810 feet long, and 60 feet base. The water is admitted into the canal through guard lock No. 3, which is 1 mile 320 yards above the dam. Cost of dam, lock, and other works connected with the feeder, ——.

No. 5 feeds 19 miles of canal, and is situated 8 miles above Williamsport. The dam across the Potomac is at ————, and is 20 feet high, 706 feet long, and 20 feet base. The water is admitted through guard lock No. 4, 320 yards above the dam. Cost ——.

Some facts I have not here been able to find out, but which I hope you will be able to obtain, should they be of any service.

Costs.—The following work, done between the Point of Rocks and the Georgetown Basin: —Common excavation, 1,893,666 cubic yards; Hard pan do., 439,071 do.; Quarry rock do., 75,472 do.; Rock blasted, 398,524 do.; Embankment, 1,533,850 do.; Puddling, 96,092 do.; Walling, 231,064 cubic perches. Costing $1,032,161; for grubbing, $12,892; extras, $40,800.

Extra on this section:—Pier, basin, and tide lock, at Georgetown, $78,943; Locks, $232,642; Lockhouses, $16,315; Bridges, $32,925; Aqueducts, $23,444; Culverts, $51,872; Waste weirs, $8,619; Dams, $30,491; Guard locks and feeders, $15,404; Improvements, $22,002.

The masonry on the dams, locks, aqueducts, pay for engineers, officers of the company, &c. are not included in the above. Items given separate.

Work done and to be done from the Point of Rocks to Williamsport—all under contract, and a great portion finished:—Common excavation, 2,733,905 cubic yards; Rock do., 433,752 do.; Slate do., 8,140 do.; Embankment, 1,350,149 do.; Puddling, 37,617 do.; Walling Stone, 181,029 cubic perches. Actual and estimated cost of the above, $936,735.74; for grubbing, $9,653; extras, $8,564.13. Total, $954,952.87, besides the masonry on locks, aqueducts, culverts, bridges, &c. &c.

I have not been able to obtain a full aggregate amount of the expenditures of the company, nor an actual statement of the entire cost of the canal. It has had to meet enormous law expenses on account of its difficulties with the Baltimore and Ohio Railroad Company; besides being subjected to very large losses in the delay occasioned by the injunction of the Chancellor of Maryland in the above case. The right of passage, too, over the various lands of private individuals has cost immense sums.

The pass at the Point of Rocks, held in dispute between the two companies, was $11,153 feet long, or $2\frac{1}{5}$ miles. The distance from Harper's Ferry to Cumberland, according to Geddes and Roberts' report, is 127 miles, and the amount of all the narrow passes where the works would come in collision would amount in all to 45 miles.

The reports of the united engineers, who have been at various times invited by the company to inspect the different portions of the work, are all declaratory of the perfect and substantial manner in which the work has been constructed throughout. These reports, have been called for by Congress, and, on being submitted, have been ordered to be printed. They contain a great deal of information relative to this grand work, and are worthy of perusal. This spring, notwithstanding the many delays and difficulties of the most arduous and imposing nature the company have had to contend with, will see the canal opened some distance above Williamsport, a distance of 102 miles of canal, and $14\frac{1}{2}$ slack water navigation, fully complying with the charter, which required upwards of 100 miles to be completed within 5 years from its commencement, or rather from October, 1828. Some report I have just got hold of, says the entire cost of this construction was $3,650,000, of which $450,000 was expended from Little Falls down.

I can add that the prospects of the canal are truly encouraging. Having command of an extensive coal region, and passing through a highly cultivated valley, where there are also numerous grist and other mills, and abundant mineral resources, besides the coal, they can never be at a loss for means of rendering the canal profitable. They cannot experience much competition, either from the Baltimore and Ohio Railroad, on account of the heavy weight of the produce to be conveyed, and cheapness of conveyance on the canal. The Washington City branch of the Chesapeake and Ohio Canal extends from the Rock Creek basin on the western borders of the city to the mouth of Tiber creek, following the bend of the river Potomac, (being constructed along the bank of that river, and in some few places encroaching on the river itself,) a distance of 1 mile and 373 yards. A tide lock at the eastern termination brings it to the level of the Potomac. The cost of this branch was $25,978.47.

Very little has yet been done on the Alexandria branch of the canal. Congress has made an appropriation of $60,000, I believe, for the construction of an aqueduct at Georgetown, across the Potomac, for the transfer of the canal to the Virginia shore. The length of this branch is 7 miles and 416 yards, and the estimated cost $372,204.55. The aqueduct has been contracted for some time since, and is now in progress of construction under the superintendence of Capt. Turnbull, U. S. topographical engineer. It is 1714 feet long; the canal way is to be 16 feet wide at bottom, 18 feet at top, and 5 feet deep, and thence, to Four Mile run, the size of the canal is to be 32 feet wide at bottom, 50 feet at top, and 6 feet deep. At the embankment, at Four Mile run, it is to be 18 feet wide at bottom, 36 feet at surface, and 6 feet deep. Thence to Alexandria it is to be enlarged to the established dimensions of the Chesapeake and Ohio Canal.

H. N. C.

City of Washington, May 27, 1834.

To the Editor of the Railroad Journal:

Sir,—I forwarded, some time since, by a private conveyance, an answer to your letter asking for information relative to the Chesapeake and Ohio Canal, which gave you such statistical information respecting that grand work as I could collect. I am not aware that it has yet reached you, though it has been nearly a month, if not more, since I wrote it. I could not then get a copy of the rate of tolls demanded on the canal, but having since succeeded, I forward them to you. This rate is only temporarily established, and it is probable, ere long, that a more favorable change will take place. Should you determine on publishing the inclosed, you will be pleased to notice the fact that this arrangement in respect to the tolls is only temporary.

Articles.	*Quantities.*	*Per mile for first 15 miles.*	*Per mile over 15 miles.*
Tobacco,	per ton of 2 hhds.	2 cents	2 cents
Wheat,	" 40 bushls	2	2
Flour,	" 10 bbls.	2	2
Offals,	" 100 bshls	2	2
Corn Meal & Rye chop,	" 40 "	2	2
Oats,	" 80 "	2	2
Flax and Clover Seeds,	" 40 "	2	2
Hemp and Flax,	" 2240 lbs.	2	2
Potatoes,	" 35 bushls	2	2
Hay and Straw,	" 2240 lbs.	2	1
Wood,	per cord of 128 c. ft.	2	½
Bark (Tanner's),	" " "	3	1
Lumber, Plank,	per 1000 ft. bd. mea.		
" Square timber	70 cubic feet		
" Shingles,	3000		
" Laths,	5000	2	1 cent, or if in rafts 2 cents
" Barrel Staves and Headings,	1000		
" Hhd. Staves and Headings,	500		
Charcoal and Coke,	per ton of 56 bushls	2	1 cent
Coal,	" 28 "	1	½
Apples,	" 12 bbls.	2	2
Cider, Ale, and Beer,	" 8 "	2	2
Whiskey and Pork,	" 7 barrels or 2 hhds.	2	2
Wine & Foreign Spirits	per tun of 250 galls.	2	2
Live Stock, Cattle,	4 to the ton	2	2
" Sheep,	30 "	2	2
" Hogs,	15 "	2	2
Lime,	per ton of 28 bushls	2	1
Plaster, Stone,	" 2240 lbs	2	1
" Ground,	" 28 bushls		
Stone, Rough,	per ton of 15 cub. ft.	1	½
" Cut or Wrought,	" " "	2	2
Grind and Mill Stones,	" " "	2	2
Iron, Pig, Castings, and Bars,	per ton of 2240 lbs.	2	2
Salt,	" 35 bushls	2	2
Fish,	" 7 barrels	2	1
All other articles,	" 2240 lbs.	2	2

Boats or scows, either empty or having cargoes, the tolls on which shall not pay 5 cents per mile, shall be charged at the rate of 5 cents per mile, and 3 cents per mile for any additional distance, which shall be considered as in lieu of the tolls on such cargoes.

Boats used chiefly for the transportation of passengers shall pay 10 cents per mile for the first 15 miles, and 8 cents per mile for any additional distance, which shall include the toll on passengers and their customary baggage; but all other merchandize transported therein shall pay the established rate of toll.

The above rates are established for the present for the use of the canal between the city of Washington and Harper's Ferry Falls; and the same rates per mile will be demanded for the use of any portion of the river between the Little Falls and the Harper's Ferry Falls; for the use of the river above Harper's Ferry Falls, the tolls established by the late Potomac Company will be demanded.

The canal is now in active operation, and will soon, I believe, be opened for several miles above Williamsport, where the slack water navigation of the Potomac is used, (for a distance, I think, of upwards of 7 miles,) making in all a distance, from the Georgetown basin, of upwards of 110 miles.

I should like you to have a copy of Dr. Wm. Howard's report on the improvement of the Monongahela river, which is, at present, a favorite project in the western part of Pennsylvania, and one which, if executed, will tend as much as any other work of internal improvement to add to the resources of that region of country, so rich in mineral and agricultural products, and where the arts have attained such perfection. Your obedient servant,

H. N. C.

To JOHN O. N. RUTTER, *Wine Merchant, for his Invention of an improved Process for generating Heat, applicable to the heating of Boilers and Retorts, and to other purposes for which Heat is required. Sealed March* 30, 1833.

The subject of this patent is the employment of bituminous, resinous, or oily matters, in connection with water as a combustible material, which, it is said, will produce a fuel for furnaces, boilers, &c. capable of giving out a very intense heat. Strange as the suggestion of applying water as a combustible material may appear, it is reported to have been found extremely advantageous, economical, and convenient. We of our own knowledge can say nothing upon the subject, but merely give the patentee's views and recommendations in reference to the manner in which he proposes to employ those materials for the production of heat.

Bituminous, oleaginous, resinous, waxy, or fatty substances, are to be employed: as coal tar, which is to be combined with water in certain proportions. It is proposed that a stream of coal tar shall be allowed to flow from a reservoir through a pipe with a stop-cock, and likewise a stream of water from another reservoir through a similar pipe; that the two streams shall meet, and fall into one general receiver with a funnel tube, by which they may be together delivered into the furnace.

The proportions are recommended to be one gallon of coal tar to one gallon and a half of water, the flow of the two liquors to be regulated by suitable apertures or stop-cock. These quantities of materials are to be slowly discharged from the funnels, that the whole shall occupy from two to three hours in its delivery into the furnace; and where the furnace is of such magnitude as to require it, several of these funnel tubes may be employed, each delivering its supply of materials in the proportions and times stated.

It is not necessary to use water in a pure state, to be mixed with the coal tar, as foul water will answer the purpose equally well; and on ship-board, where the invention may be usefully applied to steam navigation, the bilge-water from below, or sea-water, may be pumped up and employed for the purpose, and on land the ammoniacal liquor from gas works will also suit as well as fresh water.—[London Journal.]

NEW INVENTION.—A blacksmith in Virginia has invented a machine for striking, which enables blacksmiths to dispense with a striker, and at the same time perform, with the aid of one of these machines, double the amount of work which they can with the aid of one of the best strikers. The machine is propelled by the foot in the ordinary manner of turning a lathe. The inventor has secured a patent right.

NATURALIZATION OF FISHES.—At a late meeting of the Zoological Society, were read two letters from Mr. J. B. Arnold of Guernsey, detailing his experiments in the naturalization of sea fishes in a lake chiefly supplied with fresh water. The area of the lake is about five acres; its depth various; and its bottom also various, being muddy, gravelly, and rocky. The water is, during nine months of the year, drinkable for cattle, but in consequence of a supply which it receives through a tunnel communicating with the sea, is rather salt in summer, at which season the fishes do not come down so plentifully as at other times. The fishes introduced into the lake have been the grey mullet, sole, turbot, brill, plaice, basse, smelt, and grey loach. All of these have thriven well, and are believed to have increased in numbers; the grey mullet especially is known to have bred as freely as in the sea itself. A single whiting having been caught for three successive years, was found to have grown considerably; a pilchard also throve well. All the above-mentioned fishes were placed in the lake, except perhaps the brill; but others, as the silver bream, appear to have introduced themselves. It is even suspected that hybrid fishes have been produced, as several have been caught which were unknown to persons well acquainted with the species usually met with on the coast of Guernsey. Mr. Arnold adds that sea fishes, after having been naturalized in his lake, have been transferred to ponds of spring water, where they have not only lived, but done well; and that such naturalized fishes have been carried to a long distance, being much more tenacious of life than those caught in the sea.—[Proc. Zool. Society.]

QUIETUDE.—Happy, indeed, would be the condition of mankind, were all disposed to cultivate that harmony and friendship so desirable and necessary to the welfare and prosperity of society—the world would be similar to a paradise, and the people, if not angels, would approach the character ascribed to them—mankind, as they ought to be considered, would present a band of brothers, happy, quiet and content. Our citizens, from the highest to the lowest, would be satisfied with their respective stations, and the agitation which now pervades society would rest in quiet and repose.

If there is any quiet on earth, the farmer may be said to enjoy it: with a competence in store, the honest fruits of his industry, he thrives secure from the turmoils of those who pursue other avocations for subsistence. The mechanic, the professional man, and all who support themselves by speculative measures, must expect to contend against the current of disappointment, and prop their sinking hopes by anticipating future prospects; and although their situation may appear enviable to the discriminizing eye, on the contrary, they have abundant reason to envy those who live on the fat of the land, enjoying the bounties dealt out by Nature with a liberal hand.

THE FOOL HATH SAID IN HIS HEART, THERE IS NO GOD.

There is no God, the fool hath said,
With proud pretensions high.
There is no God? Who hath then made
The earth, the sea, the sky?

Who made those glorious orbs of light
That in their orbits run?
"The moon and stars to rule the night,—
To rule the day, the sun?"

Who drew the plan for all these spheres?
Who moulded, gave them form?
Who guides the comet that careers
Through space? Who rules the storm?

Who gave these motion, round to roll,
And poised them in their course?
And who has fixed their central pole,
And centrifugal force?

All nicely weighed, and balanced all,
To keep exact their course.
Who peopled this terrestrial ball—
Did chance exert this force?

Chance make an insect, plant, or flower,
And give it life, and laws!
Let chance again put forth this power
If that's the great first cause!

Intelligence and power combined,
To form the creature man;
The vast machine, the active mind,
None but a God could plan.

Wisdom and power, and goodness, shine
In all things, great and small,
And perfect skill the whole combines,
And GOD is seen in all.

There's not a plant on earth that grows,
There's not a single flower,
But what his skill and goodness shows
His all-pervading power.

The shape, the taste, the color, smell,
Are fixed by wisdom's laws,
And natures too minute to tell,
Known to the GREAT FIRST CAUSE.

Each kind diverse, its own the same,
The seed, the plant, the fruit,
All their Creator's skill proclaim,
'Tis GOD, beyond dispute.

Go, sceptic, and true wisdom learn,
————'s lectures hear.
No more the great Creator spurn,
When GOD shines out so clear!

In every animated thing,
The stamp of *God* we find,
Conviction to the heart they bring
Of UNCREATED MIND.

There is a GOD—all things declare,
Most holy, just, and wise;
Creation is his temple fair,
His palace is the skies.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 *per annum in advance*.—JOHN KNIGHT, (formerly proprietor the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

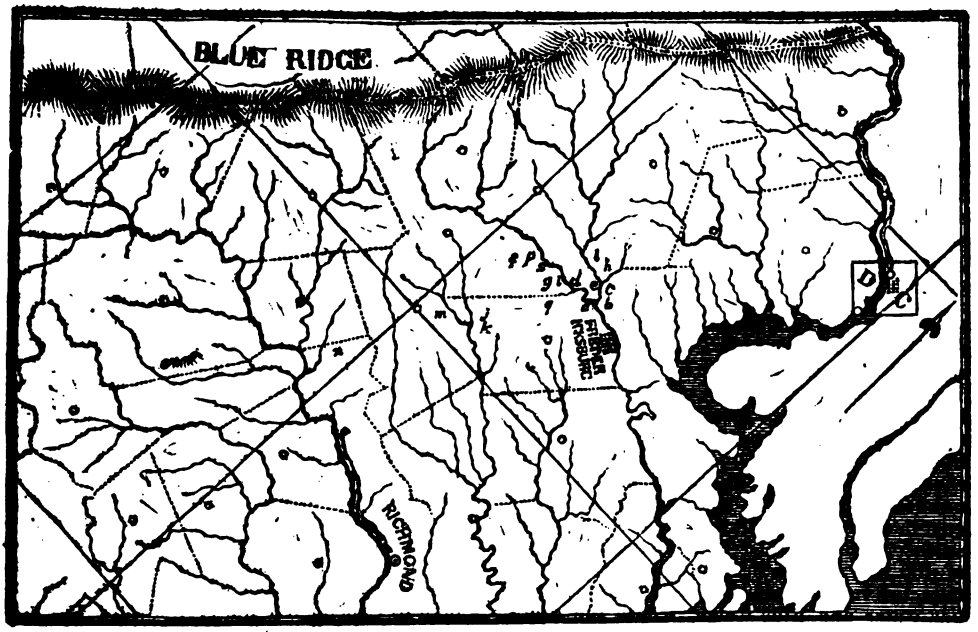
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

Volume IV.] FOR THE WEEK ENDING JULY 19, 1834. [Number 1.

"The first and last, as well as the most constant lesson, which should be impressed indelibly upon the heart, the conscience, and memory of youth, is, that goodness precedes, and is the only sure foundation of wisdom, and that true wisdom always implies substantial energy, virtue, and freedom."—Address before Troy Lyceum.

THE GOLD REGION OF VIRGINIA.



REFERENCES.

a,	United States Gold Mine,		Spotsylvania county.	
b,	Rappahannock	"	Stafford	"
c,	Rattlesnake	"	do.	"
d,	Culpepper	"	Culpepper	"
e,	Millbank	"	do.	"
f,	Virginia	"	Orange	"
g,	Vaucluse	"	do,	"
h,	Liberty	"	Fauquier	"
i,	Union	"	do.	"
j,	Johnson's	"	Spotsylvania	"
k,	Dixon's	"	do.	"
l,	Mellville	"	Orange	"
m,	Tinder's	"	Louisa	"
n,	Goochland	"	Goochland	"
o,	Booker's Willis mt.	"	Buckingham	"
p,	J. Payne's	"	Orange	"
q,	Greenwood	"	Spotsylvania	"

This map exhibits a condensed view of the gold region of Virginia, and is taken from a larger one belonging to Mr. F. Shepherd, of New-Haven, who has spent some months in surveying and exploring this interesting portion of our country. We say interesting, because the amount of gold annually obtained in the United States is estimated in millions of dollars; and this amount is rapidly increasing, when, comparatively speaking, the surface only of the ground has been disturbed in getting this precious metal.

We learn from Mr. S. that the undue excitement which the first discovery of gold creates in the minds of all classes, is now at an end in Virginia, and the business of getting gold is assuming a settled and systematic character. The farmer now goes on with his farming, and the experienced miner with his mining, and in this way each is mutually an aid to the other.

As to the richness of the Virginia ores, Mr. S. has given us full satisfaction, by simply pounding them in a mortar and washing away the sand in our presence, when, to our surprise, a large proportion of metallic gold appeared in numerous and beautiful grains, and this, too, from specimens which had no gold visible on the outside.

The following is an extract from the report of Mr. Shepherd:

"I am decidedly of opinion that Virginia is

destined, sooner or later, to become a rich and prosperous mining country; that whenever skill and capital shall be judiciously applied, (in the language of an able and beautiful writer,) she will one day be to the country what Cornwall is to England, the seat of prodigious industry, and the source of individual and national wealth."

In coming to this conclusion I do not lose sight of the great natural advantages which Virginia possesses over other mining districts in the United States, and throughout the world. It will be seen by the map, that by a little more than half a day's ride, any one can be transported from the city of Washington, on the Potomac, to the gold mines on the Rappahannock, on the banks of a beautiful river made navigable by locks and dams, a distance of ten miles to tide-water and steamboat navigation, commencing at Fredericksburg, which is a busy inland town, at all seasons supplying a plentiful market. Add to this the very low price of provisions and labor, the vast abundance of wood and timber, the great number of water powers easily created upon the numerous streams, the peculiarity of the soil and earth as affording facilities for excavation, (since steam is now applied to all kinds of digging,) and finally the beautiful developement of the rich gold veins, said by those who have been observers in both countries, by far to excel Mexico, South America, or even Russia, so much celebrated of late for her gold mines. These veins are composed of quartz, commonly called white flint, from one to four feet in thickness, generally perpendicular in the earth like a wall, supported on both sides by soft talcose slate, and extending from the surface to an unknown depth. It is not uncommon to find gold in the broken fragments of the veins at the surface, and it has also been found at the depth of 160 feet increasingly rich. The gold district lies in that part of Virginia between the tide-water and Blue Ridge, where the atmosphere is dry and exhilarating, the climate mild and agreeable, the water well tasted and pure, the inhabitants of that class so long and so justly famed for their hospitality and refinement, and for whose convenience, the great National or Southern Railroad is about to pass by them as it were at their thresholds.

Still, with all these natural and extraordinary advantages, I feel it my duty, continues Mr. Shepherd, to give my friends and fellow-citizens of New-England a few words of advice, by way of caution. That there is a very large amount of gold in the great State of Virginia, and that this large amount of gold may be extracted so as to afford a large profit, is clear to a demonstration; and I believe that this section of our country is worthy the attention of northern enterprise and capital. Yet it frequently happens that many persons have an idea that wherever gold is discovered, if they can but get possession of the lands, no matter at what price, their fortune is made for a certainty. This foolish impression has ruined many a man. The temptation is so great, that where a person wishes to sell his land as gold land, and cannot find gold upon it, in order to effect his object, he will sometimes bring gold sands and ores from a distance, and bury them upon his own grounds, which of course the purchaser finds out to his sorrow when too late. Again, some persons, on finding a few grains of gold, suppose that if they dig deep they will surely find the precious metal in masses and blocks. It is needless to add that such visionary day-dreams are rarely realized—still many are sanguine enough to pursue the chance with great ardor.

To those persons who engage in this business for the purpose of speculation, I would say that they will only be benefitted at the expense of others, and will injure the mining interest of the country more in a few days than they can possibly repair in many years.

Finally, persons ought not to engage in this business without previous skill and experience. It is obviously unsafe for them to do so; and here is the cause of so many failures of companies and individuals. Gold mining is as much an art or trade as iron mining. What company of farmers would undertake of themselves to get iron from the ore? And what would be the probable result of such an undertaking? What would be the result if this same company of farmers should undertake to work the ores of zinc, so rich and abundant in this country? I have no doubt you anticipate the result correctly; and the same result is to be expected in their undertaking to get gold. Some persons in their ignorance suppose that if they expend a large amount, or venture a large sum, that they shall certainly realize something in return. Such visionary men lose their all, generally; whereas, in the hands of a discreet and experienced man, every cent of that money, like the well directed blows of the axeman, would be turned to a good account; and instead of a loss, he would reap a reward of an hundred fold. In proof of this, I have known a man to expend ten hundred dollars and get ten thousand dollars of gold for his reward, and from an examination of his lands, believe that he might labor all his life in the same prudent way, and with the same good success. Again, I have known another man, in the same situation precisely, expend the same sum and get nothing but a load of debt upon his shoulders instead of gold. Now will you say that these mines ought not to be worked? No, you will say let them be worked by honest, experienced, and prudent men. Let this be done, and the capitalist will find his money profitably employed, and the millions of gold in Virginia will be made to circulate and gladden the hearts of millions of the human race now pining in want and "perishing for lack of knowledge."

LIGHT.—Dr. Nieuwentyt has computed that, in a second, there flows 418,660,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 particles of light out of a burning candle, which number contains, at least, 6,337,342,000,000 times the number of grains of sand in the whole earth, supposing every cubic inch of the earth to contain a million of grains.

On Enamelling Hollow Ware. By S. F. To the Editor of the Mechanics' Magazine, and Register of Inventions, &c.

Sir,—I know not to what cause it may be owing, that one of the most important and valuable improvements in the useful arts has not yet found a place in your Mechanics' Magazine and Register of Inventions and Improvements, but such is certainly the fact. The art of lining cast iron hollow ware with a coat of *enamel* or *porcelain* is certainly, in point of importance to mankind, and the credit due to its inventors, not surpassed, and cannot be surpassed, by any invention which has been or can be produced in the last, the present, or any other century.

Great credit has been given, and perhaps justly, to the inventors of spinning and weaving by mechanical power, thereby contributing to the clothing mankind, at the same time, with elegance and cheapness. But it has been objected, at least with plausibility, that these inventions serve to favor monopolies, and that they deprive the poor of labor. Great improvements have been made in the rapidity and cheapness of travelling, and transportation of goods; and to these also the world has been equally lavish in its applause.

But the advantages of wholesome food are paramount in importance to either elegant or cheap clothing, or to travelling and transportation of goods; and when we duly consider the seemingly unavoidable evils which the human family has suffered since time immemorial, from cooking vessels composed of poisonous metals, constantly subject to corrosion or oxidation—the thousands of lives absolutely cut off, and the millions imperceptibly, but evidently shortened, by slow poison—who, that duly considers the subject, can hesitate to pronounce the invention of Messrs. M. H. Webster & Co., now in successful operation in Albany, one of the most useful and most needed improvements ever made by man: since it furnishes, at a reasonable price, every vessel constituting an entire culinary apparatus, embracing all the firmness and durability of iron without, and all the neatness, beauty, and indestructibility of a China vessel within—deprived of its brittleness, and capable of enduring any heat of a common fire without injury.

Heretofore, copper vessels lined with tin have held the preference; but the tin was soon worn out or melted off, and every time they were used presented the stomach with a small portion of copper in some state or other. If vessels, of what is commonly called tin ware, were used, the tin in like manner soon disappeared, at least in spots, and presented an iron surface. If recourse was had to iron, though perhaps it contained nothing poisonous, it was sure to nauseate and discolor every thing which contained the least portion of acid. Thus we have been constantly subjected to having our food poisoned by copper, blackened by iron, or rendered unpalatable by both. By the invention of Messrs. Webster & Co. all these evils are completely remedied without a single concomitant disadvantage.

It is true, the same has been done before, by an individual in Germany, who, after long and laborious experiments, and vast expense, at length succeeded, not only in attaining his object, but in acquiring immense wealth. But it is said he keeps the knowledge still a secret within his own manufactory; it was, therefore, just as much an original invention with Messrs. W. & Co. as though no one had ever attempted it before.

The character of Dr. Beck, the partner of Mr. W., is too well established as a chemist to need eulogium, or even comment; and Mr. W., his ambitious fellow-laborer in the field of science, though young, has already done enough in conjunction with his partner to merit wealth equal to their wishes, and an imperishable name. The partners, it seemed, were not satisfied with the mere speculative results of chemical investigation—they were not satisfied to hold the light of science to aid others engaged in the useful arts—they wished to bring their light to bear upon new subjects, and show that they could venture with safety upon untrodden ground. They entered upon the subject in question, and pursued it with perseverance which could not be overcome. Their experiments were numerous and expensive, and they found difficulties which no reasoning *a priori* could have foretold. But they have overcome every discouragement.

It is now something more than a year since their business changed from a series of experiments to a regular and promising manufacturing establishment. They began upon a limited scale, as prudence would naturally dictate, intending to enlarge gradually, as the hands they employed should become waywise in the business, and acquire that practical dexterity in the manual operations which alone could establish the credit of their theory. Nothing is now wanting but to make their establishment known to the public, and to make known the advantages which must result from its encouragement. When this even begins to be effected, I should sincerely believe that no person in the United States capable of buying a pot,

a pan, or a tea-kettle, would grudge the little extra expense of such an article as above described over iron or tin; and certainly, if compared with copper, there can be no grudging in the case, as the enamelled ware will be far the cheapest. It is often hinted, that female influence rules the nation; if so, put a small article of this ware into the hands of every good housewife, and give her time to examine it, and the fortune of the manufacturers will be established; for I will pledge my reputation she will never afterwards suffer a hollow cooking vessel of any other kind to come into her house. To conclude, I should presume that no man of sense would refuse, or even hesitate, to introduce the enamelled iron hollow ware into his house in preference to any other, especially to copper, as the copper will not only cost more and be less durable, but will subject him to the certainty of swallowing at least as much copper as will make a tea-kettle in his life-time. S. F.

Large Reflecting Telescopes applicable to Exact Theoretical Astronomy. [From the Repertory of Arts.]

Sir John F. W. Herschel has rendered large reflecting telescopes applicable to the nicer purposes of exact theoretical astronomy. Although the science of astronomy itself does not fall within the plan of the Repertory, yet the construction of astronomical instruments, we conceive, belongs strictly to the department of practical knowledge which it is our purpose to improve and to extend. In accordance with this view of the object of our journal, we now lay before our readers an account of the process by which, in the accomplished hands of Sir John F. W. Herschel, (whose inheritance of his illustrious father's talents embraces alike the ingenuity required for the construction of astronomical instruments, and the accuracy, skill, and profound acquaintance with the subject necessary for their successful employment in the solution of the higher problems of astronomy,) the only obstacle which remained to the application of large reflecting telescopes to the nicer purposes of exact theoretical astronomy has at last ceased to exist.

In the second part of the Philosophical Transactions for the past year is an elaborate paper by Sir John Herschel, consisting of observations of nebulæ and clusters of stars, made at Slough, with a twenty-feet reflector, between the years 1825 and 1833. An appendix explains the manner in which the reduction of the observations, of which the paper itself is a collection, has been executed by the author. It is in the course of this explanation that the final improvement of the reflecting telescope is described. A difficulty presented itself in the reduction of the observed polar distances to mean polar distances at a fixed epoch, arising from considerable fluctuations in the value of a certain expression, which was a function of the times of the transit of the objects observed over the vertical wires of the eye-piece of the telescope. These fluctuations in value, to which the function alluded to was found to be liable in very variable degrees at different epochs of the observations, were occasioned by instability of the instrument, which was partly due to hygrometrical changes, but by far the worst and most intractable part of the fluctuations appeared "to have taken its rise from the shifting of the line of collimation, owing to the mirror taking a new bearing in its cell." "I regret," continues Sir J. Herschel (Phil. Trans., 1833, p. 488), "that I did not earlier perceive this cause of error. It has only recently occurred to me, and the remedy almost at the same instant suggested itself in a simple, and what, I trust, will hereafter prove an effectual application, of the collimation principle of Rittenhouse and Kater. It consists in attaching to the *inside* of the wooden tube of the reflector a small achromatic telescope, having its object glass turned towards the speculum, and its eye end projecting at right angles to the axis of the tube through an aperture in the side, the cone of rays being deflected outwards at a right angle by a small mirror 45° inclined to its axis. In the focus of the object glass (thus rectangularly deflected,) is fixed a cross of fine spider-lines, strongly illuminated by a lamp (capable of being shut off when not wanted,) which also serves to illuminate the field. The cross is so situated, that its image, seen in the telescope as an object infinitely distant, (according to the principle of the collimator,) makes, with all its arms, angles of 45° with the horizontal and vertical wires of the sweeping eye-piece. In the beginning of a sweep, the intersections of both crosses are brought to exact coincidence (by a method presently to be explained); and it is evident that if in the progress of the sweep the slightest shifting of the mirror in its cell should produce a motion of the line of collimation, it cannot fail to be detected by the apparent recess of the two crosses from their original common intersection. A relative motion, to the amount of two seconds of space, either laterally or vertically, cannot possibly escape detection, as I have convinced myself by many trials; and so satisfactory has this mode of overcoming the dif-

ficulty in question proved, that I have no hesitation in saying, that the only obstacle to the use of large reflectors for the nicer purpose of exact theoretical astronomy (viz. the error caused by the shifting of the mirrors in their cells, by reason of their great weight, and the danger of securing them by strong pressure,) has ceased to exist. It is not, however, sufficient to have the means of readily detecting error, without possessing that of correcting it with equal readiness, or at least measuring its amount. A very simple and effectual contrivance accomplishes this. The two adjusting screws by which the mirror case is supported against the bottom of the tube are terminated outside of the latter by large disks or wheels of wood about six inches in diameter, grooved at their edges. Round these re-entering cords are conducted over pulleys, to a convenient point within reach at the mouth of the tube, forming a kind of reins, which hang loose when not in use, but by tightening or drawing one or other of them, any motion, however large or minute, may be given to the line of collimation at pleasure. By the aid of this mechanism, the perfect adjustment of the line of collimation (to the full extent of the optical powers of the instrument) is performed in an instant, and may, if we please, be repeated at every observation, being attended with no trouble; nay, the line of collimation may be purposely deranged to any extent, and immediately corrected. So that by graduating the grooved disks, and adopting an index to each, a very complete distance and position micrometer, for the measurement of double stars, might be formed, in which, if necessary, two lucid points might imitate the two stars to be compared."

To the foregoing account of his application of the collimating principle, Sir J. Herschel annexes the following note:

"My first collimator consisted of a small object glass, by Fraunhofer, of about one inch and a half in diameter, and twelve inches focus. When applied to the twenty-feet reflector, as described in the text, it formed an admirable microscope with its full aperture—an extraordinary proof of the perfection of its construction, this being, doubtless, the severest test to which an achromatic object glass can be possibly subjected. The most beautiful object I can remember to have seen in telescopes was Jupiter entering, perfectly defined, and with all the appearance of a real globe, into the image of a small glass globule, placed in the focus of the collimating telescope. It seemed like the mutual penetration of two solids, or rather two essences of different natures, the one bright and ethereal, the other dark and adamantine. This most exquisite specimen of workmanship was destroyed by an accident. That with which I have been forced, temporarily, to replace it, bears no comparison with the original."

On the Employment of Filters in Chemical Analysis. By Dr. Turner, Professor of Chemistry in the University of London. [From the Repertory of Arts.]

In my own researches I am in the habit of determining the weight of substances collected on a filter in one of three different ways. One of these, introduced by Berzelius, consists in burning the filter in a platinum crucible, and deducting the weight of its ashes. This method is peculiarly applicable to the analysis of minerals where such substances as silica, alumina, and lime, are frequent. Even some substance of easy production, such as peroxide of iron and sulphate of baryta, may be safely treated in the same way; but in these cases it is advisable, not only, as usual, to separate the mass of the precipitate from the filter before setting it on fire, but to moisten both with a little nitric acid, and to insure very free exposure to the air during the burning of the paper and the subsequent ignition. For such purposes I commonly use some excellent Swedish filtering paper, kindly procured for me by Berzelius.

Another method is that of the double filter, introduced by Dr. Thomson, which I have used in all the experiments where filtration is spoken of in the present and former communication. Both Berzelius and Dr. Thomson himself seem inclined to doubt the accuracy of this method; and it is certainly liable to objection, except with certain precautions and with very compact filtering paper. The paper which I use for the double filter is considerably thicker than the Swedish paper, and of such compact texture, that recently precipitated oxalate of lime, or sulphate of baryta, thrown down by Glauber's salt in a neutral solution of the chloride of barium, may be filtered by it. The precautions employed are these: The paper, folded into filters, is macerated in dilute nitric acid for two days, is then fully washed with warm distilled water, and dried at a temperature of 212° Fahr. After acquiring its hygrometic moisture, two of the filters of nearly the same weight are poised against each other, and any small difference marked in pencil on the lighter one. Before being used a pin-hole is made in the outer

filter, in order that any accidental imperfection in the inner filter should be made apparent. After filtration both filters are dried at the same temperature, and are afterwards allowed to recover their hygrometric moisture completely before removal to the balance. In repeated trials I have found a pair of filters to recover, after use, their original relation in weight to within the 100th part of a grain; nor have I ever noticed a greater deviation than may well be expected in every process where filtration is concerned. Additional testimony of the same kind will be found in my Essay printed in the Philosophical Transactions for 1819 [1829], where, in two sets of experiments, the same point is investigated by the use of double filters, and by evaporating the precipitate to dryness without filtration.

A third method consists in employing a single filter, which is dried, before and after filtration, at some fixed temperature, as at 212° Fahr.; and when so dried, is inclosed in a light silver vessel, the cover of which is tightly fitted by grinding. The filter may thus be deliberately weighed without absorbing moisture during the operation. In case of its being inconvenient to employ an uniform temperature, the filter may be dried at a variable heat, be allowed to absorb hygrometric moisture, and afterwards kept at about 50° Fahr. for two hours in a closed bottle, the bottom of which is covered with pulverized quicklime. In this method, while operating at least with paper of English manufacture, it is essential, more so than with the double filter, to have previously macerated the filter in dilute acid; for all such paper which I have examined contains lime.—[Phil. Trans., 1833, Part ii. p. 542.]

Orffyreus' Wheel.—Gravesend, in his Œuvres Philosophiques, published some time about 1774, at Amsterdam, gives an account of a singular machine constructed by one Orffyreus, which was styled a perpetual motion. The facts in relation to it, as nearly as we can ascertain, were simply these: A large circular wheel, twelve feet in diameter, and fourteen inches thick, was made of very light thin deal boards, resembling a drum, as mechanics call it, for carrying bands. The sides, or rather ends, were covered with waxed cloth, to prevent any one from discovering the inside. Through the centre was an iron axle, the gudgeons of which rested on two upright pillars, in the manner of hanging a grindstone. On giving it a slight motion either way, its revolutions speedily increased to twenty-five a minute. For two months it never varied in the least from that motion. Being placed in a chamber, at the residence of the landgrave of Hesse, the door was fastened, and the seal of his highness placed on the lock. At the expiration of sixty days the apartment was opened, and the wheel found revolving at the usual speed. It was then stopped to prevent it from being worn out. The inventor was so incensed because Professor Gravesend undertook to examine it, that he broke it in pieces before his face. The landgrave once saw the inside, but, being sworn to secrecy, only said it was very simple. Both the inventor and his friend died soon after, and all knowledge of its construction is therefore lost to the world.—[Scientific Tracts.]

Sea Sledge.—Mr. Buder, Counsellor of Mines at Munich, in Bavaria, some years ago invented what he termed an aquatic sledge, constructed on such a principle that it might be impelled and guided on the water by the rider himself, without any other aid. The first public experiment was made with this machine on the 29th of August, before the royal family, at Nymphenburg, with complete success. It is described as consisting of two hollow canoes or pontoons, eight feet long, made of sheet copper, closed on all sides, joined to each other in a parallel direction at the distance of six feet by a light wooden frame. Thus joined, they support a seat resembling an arm chair, in which the rider is seated, and impels and steers the sledge by treading two large pedals before him; each of these pedals is connected with a paddle fixed perpendicularly in the interval between the two pontoons; in front of the seat stands a small table, on which he may read, write, draw, or eat and drink. His hands being at perfect liberty, he may even play an instrument, load and fire a gun, or do whatever he pleases. Behind the seat is a leather bag, to hold any thing he may want in his excursion. It is evident that this machine must be admirably calculated for taking sketches of aquatic scenery, as also for the diversion of shooting water fowls, in which case the sportsman conceals himself behind a slight screen of branches, or rushes, so as to approach the birds unperceived. The vehicle is far safer than a common boat, the centre of gravity being constantly in the middle of a very broad base, a circumstance which renders upsetting, even in the heaviest gale, absolutely impossible. It is, moreover, so constructed that it may be taken to pieces in a few minutes, packed in a box, and put together in a very short time."—[Court Journal.]

Phrenology, continued—Mimicry, or External Manifestation of the Action of the Organs.

[The figures 1, 2, 3, and so on, have reference to corresponding figures at page 321, vol. iii. of this Magazine.]

1. When the organ acts with a certain degree of force, the head and body are strongly drawn back, the whole erectile system, together with the attitudes and movements, announce the species of delirium with which the individual is attacked.

2. The mimicry of this organ is more calm than that of the preceding. It generally consists, in particular cases, in tender caresses and acts of kindness.

3. When this organ acts strongly, the head and the body are slightly inclined to one side and backwards. The ancients appear to have observed this, and to have represented it in the beautiful group of Castor and Pollux, which may be regarded as the perfect expression of the most tender friendship.

4. In the action of this organ the body is drawn up, the legs a little apart, the arms drawn back, the fists shut, and the eyes threatening. The poltroon, on the contrary, scratches the ear as if to excite the organ.

5. The mimicry of this organ has much analogy with the preceding; the whole body has an extreme tension, in accordance with the feelings of the individual. All the motions are violent, and the sparkling eyes watch the victim.

6. The movements of the cunning man bear the impress of mystery; he moves with stealthy steps, looking around him with caution, and already pointing out with one of his fingers the intended victim of his cunning. The cat in her sports, and animals who watch their prey, are examples.

7. It is particularly in the avaricious man that we recognize the gesture of this instinct. The head is generally inclined forward, the arms tense, and the hand open, as it were to receive, and sometimes half shut, as if to retain what he gives.

8. The gesture of pride is unequivocal—no one mistakes it. Man, under the influence of this sentiment, carries the head high, with the arms sometimes advanced, in an attitude to command, sometimes raised, as well as the eyes, as if to announce self-sufficiency and a contempt for others.

9. The vain man directs his eyes from side to side, to see whether his walk and the elegance of his habits are observed. He cuts the air with his gestures, and balances himself with an air; but this gesticulation is still more prominent in the coquet.

10. Circumspection generally appears more developed in females than in the other sex, and in weak and timid animals more than in those which are courageous. The anxious individual turns the head from side to side, and insures his safety by a thousand precautions.

11. The gesture of this organ is but little perceptible. It resides principally in a certain tension of the head, and in a particular aptitude to scrutinize objects which present themselves to our observation, and afterwards to meditate on their effects.

12. The man who seeks his path generally carries the index finger before his eye, the point resting on the organ. The situation of places is indicated by movements of the arms and hands.

13. When one tries to remember a name that escapes him, his eyes are fixed and raised, a certain tension is felt in the region of the organ, and generally the hand is carried to the eyebrow; it presses and scratches the interior part of the forehead, as if to stimulate the organ.

14. The gesture of this organ is little marked; rather it is calm like that of most of the intellectual faculties. Yet in the orator, who speaks extemporaneously, or who searches for words which escape him, this organ is observed to become a centre of efforts.

15. The mimicry of the latter kind of memory, as well as that of the preceding, is essentially internal, and resides in a certain immobility of different parts of the body, and a strong tension of the organ.

16. The mimicry of this organ appears to be entirely referable to admiration. It is this sentiment, in fact, which predominates on the view of a smiling valley, a picturesque and romantic situation, a picture which presents rich and glowing colors, or a splendidly decorated apartment.

17. The mimicry of this organ has relation to measure and cadence. By it the skilful general hastens or retards the march of his warriors, and by heroic songs excites them to carnage. In the same manner the priest, by sacred hymns, inspires the soul with hope or terror.

18. In the action of this faculty, to which M. Gall likewise refers that of time, or the faculty of remembering epochs and dates, all others are, as it were, absorbed by the present object, and the individual becomes to a certain degree a stranger to what passes around him.

19. The mimicry of this organ is as much in the reflection as in the attitudes and the movements. To form an idea of it, we must behold a sculptor examining his work,

a fashionable milliner showing a hat, and endeavoring to give it the air required by the taste of the day.

20. Attention is the principal attribute of this organ, which, besides, varies according to the degree of meditation which it produces. The arms are often fixed across the chest, and the eyes fixed upon the object of attention, and the frontal region more or less tense.

21. Like that of all the intellectual faculties, the mimicry of this organ is calm and silent. It consists essentially in an immobility, almost complete, of the trunk and the limbs, which is succeeded by a movement of the eyes towards the heavens.

22. The mimicry of this organ consists particularly in counterfeiting the gestures and attitudes of others, with a manifest intention of mocking them. It appears to be the proper corrective of our faults, and of our ridiculous self-love and vanity.

23. Independently of the immobility of the body, and the tension of the head, a respiration, as it were suspended, announces the intellectual efforts necessary to seize the vast chain which connects together all the phenomena of the universe.

24. If we observe the poet who composes, we behold him in his ecstacy at one time raise the head obliquely towards the heavens, as it were to invoke its influence; at another time, place his hand upon the organ, as if to excite its action.

25. It cannot be denied that acts of atrocious perfidy are perpetrated; nevertheless, the contrary dispositions are more common to the multitude. Under ordinary circumstances, man is naturally good, and the mimicry of benevolence is one of the manifestations of a happy people.

26. We must take care not to confound pantomime with mimicry; the latter consists in a natural expression of our sentiments and faculties by gestures and different attitudes of the body. Pantomime, on the contrary, is the imitation of the gestures and attitudes of others.

27. In the action of this organ, the mimicry varies with the subject of the vision. If the object is sacred, the person presents on his visage an impress of unction and superhuman inspiration. If the vision relates to horrid crimes, the face has then the aspect of terror.

28. As the organ of theosophy is at the same time that of veneration, its mimicry varies according to circumstances. In devotion, all the parts of the body are directed towards the heavens; in veneration, on the contrary, they are bent towards the earth.

29. If we remark the man who makes a firm resolution to prosecute an undertaking in defiance of every thing, and without permitting any obstacle to obstruct him, we instantly observe him to raise his whole body, and to advance as if he already wished to brave all obstacles.

Depth of the Ocean.—One mile and sixty-six feet is the lowest depth to which the ocean has been sounded. Where the coast is rugged and high, the water is deep. All the surface covered by seas is three times greater than the dry land, being 148 millions of miles. If the medium depth of the sea be reckoned at two miles, there must consequently be 296 millions of cubical miles of water. The quantity, therefore, is sufficient to cover all the known dry land on the globe to the height of *eight thousand feet;* and further, were all this mass of water thrown into the shape of a ball, it would be *eight hundred miles* in diameter. Philosophers of enlarged views generally believe that the present beds of all oceans were at a former period the habitable parts of the earth. There is no other mode of explaining the presence of such immense masses of marine productions, quite in the interior of all the continents, as are continually brought to light, than by supposing they were once covered by the sea.—[Scientific Tracts.]

American Mammoth.—Professor Silliman, of Yale College, has recently delivered a course of lectures on geology at Hartford. In the course of one of them he exhibited to his audience one of the joints of the back bone of a huge Mastodon, or American Mammoth, recently discovered in excavating a race-way in the western part of Berlin. The Connecticut Courant states, that "the bone was in fine preservation, the principal change being in the color. It was probably one of the joints near the loins, where the back bone (from this specimen) must have been about 18 inches in circumference. This joint has a bone rising from the top of the vertebral column, about 14 inches, and sloping backward at an angle of 25 or 30 degrees. From the perfect condition of the bone thus accidentally discovered, there is reason to believe that a complete skeleton may be recovered by a persevering and diligent search in the morass where the specimen in question was found. Such a skeleton would be a noble memorial of the vast animals which once roamed through New-England."

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from vol. iii. page 343.)

The valves have no power of accelerating the motion of the blood; they only prevent its retrograde motion, and cause the whole power of the heart to be employed in directing the blood forwards in the course of the circulation. But when they are ruptured, when the valve first described is rent, or the cordæ tendineæ are broken, then the membrane, which we have said is like a sail, is carried back from the second into the first cavity. It is like the sail torn from the sheets and flying out before the wind: the effect is terrible: the pulse of the heart, the whole force of which should be given to carry the blood forwards in the arteries, has half its force directed backwards upon the veins.

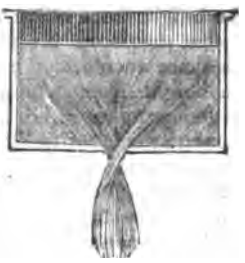
In the same manner the semi-lunar valves in the root of the aorta may have their margins torn. We have described the margin of these valves to be strenghtened by a tendon or cord run along their edge, like the rope which is sewed to the edge of a sail. There is an obvious intention in strengthening the valve here, but when textures of this kind become impaired in the human frame, this may give way and be torn, and then the re-action of the artery, when the heart has given its stroke, is lost; for, instead of impelling the blood forwards, the blood runs backwards into the heart. The effect of these accidents is extreme debility of circulation, with symptoms varied according as the defect falls on the circulation through the lungs, or through the body—that is, whether on the right or the left heart of man. But such accidents are rare, and never take place until disease has impaired the strength of what we may call the tackle of the valve.

The next remark is founded more directly on the hydraulic principle.

This ring and these valves, at the beginning of the great artery, imply a certain constriction or diminution of the tube at this part, and we have now to show that such a contraction of the tube at this precise part does not diminish the diameter of the column of blood. This appears an inconsistency; but if a stream of water flow from a cistern, through a hole in that cistern, the column of water will be diminished at a certain point of its exit.

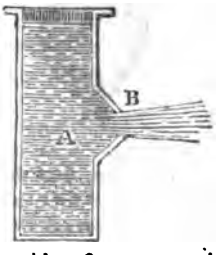
The water flowing through the bottom of the cistern may be represented by converging lines; and their united forces impelling the stream forward, contract it just beyond the exit—the *Vena Contracta*. Nature, taking advantage of this law, has constructed the narrow ring which we have shown is necessary to the accurate adjustment of the valve, at the precise part where the blood, issuing from the cavity of the ventricle, is necessarily contracted to the smallest space. The column of blood would be contracted at this point, even if there were no coats of the artery to confine it there.

Fig. 9.



We had thought of this as a thing indicated by reasoning, but we find that an appropriate experiment has been made which proves it.

Fig. 10.



A being the side of a reservoir, and B a short tube giving issue to the water, it will deliver as much water by this conical constructed mouth as if the tube were of equal diameter with the hole in the reservoir. The reader will perceive how satisfactorily this indicates what is designed by the difference in the size of the mouth of the ventricle which gives entrance, and that which gives issue to the blood.

With a view to explain the motion of fluids in tubes, and finally the motion of the blood in the blood-vessels, let us consider what takes place in the motion of the column of water which is not contained in a tube.

When water is poured out, and descends in an uninterrupted stream, the column contracts as it descends, until it has acquired such a velocity that the atmosphere opposes it and scatters it; we do not mean the contraction illustrated by fig. 9, but that gradu-

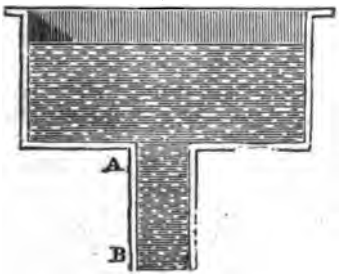
al diminution of the diameter of the stream, owing to the height from which it falls. We apprehend that this is on the principle that falling bodies are accelerated as the square root of the height from which they fall. The stream being more rapid at its lower part, is necessarily smaller in diameter, until having acquired considerable velocity the resistance of the atmosphere separates its filaments, and it becomes broader again.

A very different appearance is presented in a jet d'eau; here the ascending stream

Fig. 11.

widens as it ascends. The explanation of this we conceive to be, that the fluid is retarded as it mounts, and that the stream propelled from below is forced between the filaments* of the column above, and disperses them, so as to give the column a conical form.

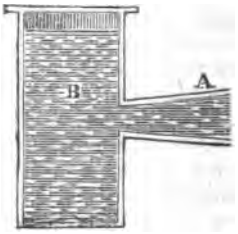
Fig. 12.



This reservoir will be emptied more rapidly, if, instead of a hole in the bottom at A, the water be discharged by a tube, A B, of the diameter of the hole. Here the column of water being perpendicular, it will be accelerated at its lower part; but instead of diminishing its diameter, as it would do if not confined by a tube, it will draw an additional volume of water down, and accelerate the discharge.

It will be very different if the force be altogether from behind, as when water is propelled into a horizontal tube.

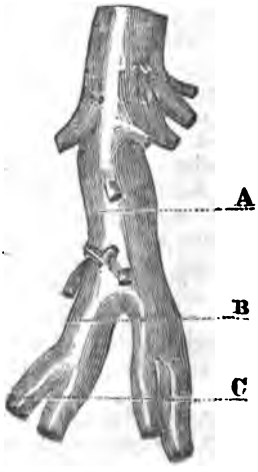
Fig. 13.



The tube A being conical, will discharge more fluid from the reservoir B than if it had been of equal length, and its diameter throughout the same as at its commencement. Because, as it appears to us, the weight of the descending column being the force, and this operating as a *vis a tergo*, it is like the water propelled from the jet d'eau, and the gradual expansion of the tube permits the steam from behind to force itself between the filaments, and disperses them, without producing that pressure on the sides of the tube which must take place where it is of uniform calibre. These principles will give great interest to the following fact.

The celebrated John Hunter took great pains to prove that the artery had its diameter enlarged as it proceeded from the heart, and that the areas of the branches of an ar-

Fig. 14.



* Those who treat of hydraulics divide a column of water into ideal lesser columns, which they call filaments, with a very different meaning from the fibres of the anatomists.

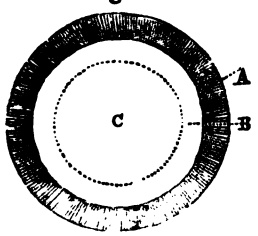
tery were greater than the diameter of the parent trunk.

That is to say, the section of the trunk, at A, was not so great as the two sections, at B, taken together; that the two sections at B taken together were not so great as the four sections at C; that the conjoined diameters, therefore, of the branches of an artery were greater than the diameters of the artery itself. This fact has been sometimes expressed by saying that the artery was a cone with its apex in the heart.

When we stand by a rapid river, we can perceive that the surface of it is not level. The stream is rapid in the middle, and there the water is highest. The friction of the water against the bottom and the sides retards the stream, whilst the greater velocity of the current in the centre draws the water to it, which is the reason of its elevation there.

For the same reason, if an engineer estimate the quantity of fluid to be delivered through a tube without estimating the friction of the sides, he will be disappointed in the result of his calculation; for as the water of the river is delayed by the bottom and sides, so is the fluid in the tube retarded by the attraction or friction between the water and the tube. And if we can imagine a section representing the tube and the flowing

Fig. 15.

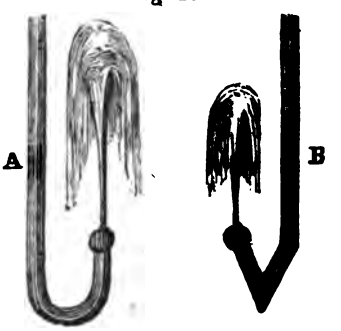


water, A will be the solid tube, B the water retarded or arrested by the friction against the tube, and the space C, within the inner circle, would represent that part of the stream which is in uninterrupted flow. The engineer will, therefore, lay a tube larger than would be necessary, were there neither attraction nor friction between the solid and fluid. It must further appear that the smaller the calibre of the tube, the surface of attraction or friction will be proportionally greater. Does not this explain the anatomical fact which we have been contemplating, that the area of the smaller branches is comparatively larger than the trunk from which they are derived?

Two beneficial effects result from this: for we must observe that the blood-vessels of the body are reservoirs as well as conduit pipes. A man of middling stature has 33 lbs. of blood in his circulating vessels; if the vessels did not enlarge as they receded from the heart, there would be no place for the deposite of this great quantity of blood. The advantages, then, of this particular form, are, *first*, that a quantity of blood necessary to the economy is contained within the vessels; and, *secondly*, that the blood is more easily urged forwards by the action of the heart. The reader will not now be surprised in learning, that a pipe of a conical form, that is, enlarging as it proceeds, gives the least interruption to the flow of water from a reservoir.

Water flowing in a tube will be retarded by any sudden angle in the tube. If the ad-

Fig. 16.



jutage of a jet d'eau have not a gentle and uniform sweep where it is turned, the jet of water will not reach the height which it ought to do by calculation of the height of the reservoir of water from which it descends: it will go higher from the tube A than from B. This circumstance explains the uniform and parabolic curve which the great artery of the body takes in first ascending from the heart. It explains also why the branches of the great artery go off at different angles, according to their distance from the heart, or, in other words, why they pass off at smaller angles with the stream the farther the artery recedes from the heart.

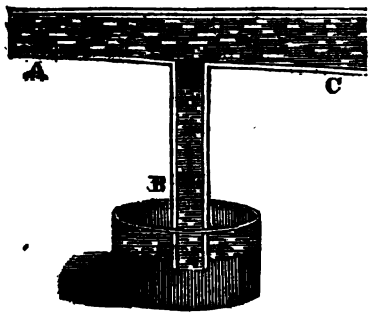
In the distribution of water pipes, it is very necessary to attend to the angle at which the small pipe is attached to the greater one, not only because a pipe being bent abruptly causes loss of motion from the impulse of the fluid against the side, but also from another well known law of hydraulics.

If a pipe be fixed into another so as to join it at an angle contrary to the direction of the stream, the discharge into that lateral branch from the larger tube will not only be much smaller than we might estimate by the

diameters of the tubes, but, in certain circumstances, it will discharge nothing at all; nay, on the contrary, the water would be drawn from the lesser tube into the greater, until the lesser tube be emptied, and air be sucked in.

Bernouilli found that when a small tube, B, was inserted into the side of a horizontal

Fig. 17.



conical pipe, A, in which the water was flowing towards the wider end, C, not only none of the water escaped through the small tube, but the water from a vessel placed at a considerable distance below was drawn up through the tube B into the pipe A.

The Pleasures of Science.—The man of knowledge, even when shrouded in darkness and in solitude, where other minds could find no enjoyment, can entertain himself with the most sublime contemplations. He can trace the huge globe on which we stand flying through the depths of space, carrying along with it its vast population, at the rate of sixty thousand miles every hour, and by the inclination of its axis, bringing about the alternate succession of summer and winter, spring and harvest. By the aid of his telescope he can transport himself towards the moon, and survey the circular plains, the deep caverns, the conical hills, the lofty peaks, the shadows of the hills and vales, and the rugged and romantic mountain scenery which diversify the surface of this orb of night. By the help of the same instrument, he can range through the planetary system, wing his way through the regions of space, along with the swiftest orbs, and trace many of the physical aspects and revolutions which have a relation to distant worlds. He can transport himself to the planet Saturn, and behold a stupendous ring, 600,000 miles in circumference, revolving in majestic grandeur every 10 hours around a globe 900 times larger than the earth, while seven moons, larger than ours, along with an innumerable host of stars, display their radiance to adorn the firmament of that magnificent world. He can wing his flight to the still more distant regions of the universe, leaving the sun and all his planets behind him, till they appear like a scarcely discernible speck in creation, and contemplate thousands and millions of stars and starry systems, beyond the range of the unassisted eye, and wander among suns and worlds, dispersed throughout the boundless dimensions of space. He can fill up, in his imagination, those blanks which astronomy has never directly explored, and conceive thousands of systems and ten thousands of worlds, beyond all that is visible by the optic tube, stretching out to infinity on every hand—new creations incessantly starting into existence—peopled with intelligences of various orders, and all under the superintendence and government of the "King Eternal, Immortal, and Invisible," whose power is omnipotent, and the limits of his dominions past finding out.

It is evident that a mind capable of such excursions and contemplations as I have now supposed must experience enjoyments infinitely superior to those of the individual whose soul is enveloped in intellectual darkness. If substantial happiness is chiefly seated in the mind, if it consists in the vigorous exercise of its faculties, if it depends on the multiplicity of objects which lie within the range of its contemplation, if it is augmented by the view of scenes of beauty and sublimity, and displays of infinite intelligence and power, if it is connected with tranquillity of mind, which generally accompanies intellectual pursuits, and with the subjugation of the pleasures of sense to the dictates of reason—the enlightened mind must enjoy gratifications as far superior to those of the ignorant, as man is superior in station and capacity to the worms of the dust.—[Dr. Dick.]

The Christian Religion.—If we would learn the value of this to the world, let us travel in countries where the Bible is not known, and contrast their situation with our own. Go then into a heathen country, no matter in what direction, or at what age of the world, and you will find,—

No equality between the sexes. Man is stronger than the woman, and therefore he has made her his slave, the minister of his pleasure. Companionship between husband and wife is unknown, and the connection dissolved at the interest or caprice of the former.

You will find but little parental or filial

affection. The mother neglects or exposes, or actually destroys her own child; the child grows up to beat its mother or father, to neglect them in their old age, and finally leaves them to perish, untended and unmourned.

You will find no such thing as honesty, or truth, or rarely, indeed, in their dealings with one another. Supreme selfishness, without the least regard to others, regulates the conduct of every individual. Legal justice is a thing unknown—mercy an attribute seldom exercised. You will find none of those institutions, which, in Christendom, adorn human nature, and which serve to alleviate so many of its woes. When you have travelled beyond the influence of the Bible, you will find no "Foundling Hospital," no "Lunatic Asylum," no "House of Refuge;" you will look in vain for the "Orphan's House," the "Sailors' Snug Harbor," or a "Retreat," for the blind, the deaf, or the poor. Institutions like these are never found except by the side of temples erected to the God of the Bible.

What shall we say, then, to those men, who, incendiary-like, are seeking to destroy the influence of the Christian religion, and who would fain persuade us to burn up our Bibles, and pull down our churches? What else shall we call them than enemies of themselves and their kind? What would these men have? Even were there no hereafter—even though existence terminated at death—though the bible were a lie, or a fable, this life a dream and the next a fancied vision—we say, even though the enemies of the Bible were capable of proving all this to a demonstration, what would be gained to the human race by doing so?

These are questions which the infidels and free-thinkers of the age dare not ask themselves; or if any ask, they dare not answer them, for then would they stand self-convicted of conspiring against the good order, the peace and happiness of society. Deluded men! why seek to accomplish what, at best, would only tend to embitter the short-lived joys of earth; but which, if you would listen to the voice of reason and conscience, they would tell you, would send man hopeless to his grave, and beyond that shut him up in the prison of despair.

Subjects of Inquiry.—The following, among others, are still subjects of speculation and controversy: What is national wealth? the means of producing it? the influence or action of the generating causes? their immediate or distant effects? their apparent or actual results? the different ramifications of the sources of wealth, such as labor, capital, the circulation of commodities or commerce? and the revenue or consumption? the source of wealth, whether in labor, foreign commerce, land, or capital stock? in what capital consists? the nature of money? the proportion which the circulating money of a country bears to the whole value of the annual produce circulated by it? Whether labor is the standard of value, and whether there is an immutable standard measure of value? whether agricultural labor is exclusively productive, or most productive? and perhaps the most controverted subject of political economy is, whether the home or foreign commerce is most productive of national wealth?—[Scientific Tracts.]

Camphor in India.—In the bazaars in the East Indies, camphor is always exposed for sale in the open air, surrounded by a few pepper-corns, *which prevent the evaporation of the camphor.* Our correspondent, "Bergem," to whom we are indebted for this fact, and for so many other valuable communications on Indian arts and manufactures, habits, and customs, &c. asks, "What is the chemical principle on which this remarkable effect depends?" We shall be happy to receive from some of our chemical correspondents a satisfactory answer to the inquiry. The principles of affinity and repulsion, which determine the peculiar properties of different colors, have hitherto received but little attention, though there are few subjects more calculated to awaken curiosity or reward investigation.

Cause of Fevers.—Hudson, the discoverer and first navigator of Hudson's river, on the 6th of September, sent a boat to sound the Kills between Bergen and Staten Island, and his men, on their return, reported that the "lands were as pleasant with grass and flowers, and goodly trees, as ever they had seen, and very sweet smells came from them." This is not now the case. The grazing of cattle, the rooting of swine, the plough, and other implements of agriculture, have entirely destroyed a great number of the annual grasses and plants which formerly flourished in this country. Several persons told Kalm, so far back as 1748, that the loss of many odoriferous plants, with which the woods were filled before the arrival of the Europeans, but which the cattle have now extirpated, might be looked upon as a cause of the greater progress of the fever; for the greater number of those strong plants occasioned a pleasant scent to rise in the woods every morning and evening. The ve-

getable kingdom of our western country is uncommonly rich, and luxuriantly abundant, because cultivation has been but partially extended to it. Hogs have produced great destruction among all tuberous and bulbous roots. Even the laurel tree of Carolina has become almost extinct in many parts of the country, owing to the depredations of domesticated animals.—[Scientific Tracts.]

Mixed Blood of Americans.—"It is acknowledged," says Cicero, "that literature, polite arts, religion, agriculture, laws, and social rights, originated in Athens, and were thence distributed over all nations." The fertility of the soil, the excellence of the climate, the freedom of the government, and the enterprising spirit of the people, must have co-operated in producing this transcendant and pre-eminent state of human exaltation. And if a comparison was instituted in those respects between that country and ours, in what important part should we be deficient!

We are perhaps more favored in another point of view. Attica was peopled from Egypt, but we can boast of our descent from a superior stock. I speak not of families or dynasties; I refer to our origin from those nations where civilization, knowledge, and refinement, have erected their empire, and where human nature has attained its greatest perfection. Annihilate Holland, Great Britain, Ireland, France, and Germany, and what would become of civilized man? This country, young as it is, would be the great Atlas remaining to support the dignity of the world: and perhaps our mingled descent from various nations may have a benign influence upon genius. We perceive the improving effects of an analogous state upon vegetables and inferior animals. The extraordinary characters which the United States have produced may be in some measure ascribed to the mixed blood of so many nations flowing in our veins; and it may be confidently predicted, that the operation of causes, acting with irresistible effect, will carry, in this country, all the improveable faculties of human nature to the highest state of perfection.—[Ibid.]

Coal *vs.* Gold.—In a work lately published by a Spaniard, there is a comparison between the produce of the gold and silver mines in America and the coal mines in England, from which it appears that the gross value of the annual produce of the coal mines, which is 18,000,000 tons, amounts to 450,000,000 francs, including the wages and other charges; whilst the produce of the gold and silver mines, including the same charges, is only 320,500,000 francs: showing a balance in favor of the coal mines of England, over the gold and silver mines of the New World, of no less a sum than 227,500,000 francs.

Silk Manufacture and Morus Multicaulis.—About the year 1824, M. Perottet, a distinguished travelling botanist, introduced this valuable plant into France. He procured two specimens at Manilla, the capital of the Phillippine Isles, and carried them to the Isle of Bourbon, and from thence into Cayenne and France. Now there are millions in Europe, Asia, and America, growing from those two plants; and in a few years, there will be additional millions. From an article in the New-England Farmer, by Wm. Kenrick, we extract the following:

The sudden and extraordinary extension of the silk manufactures, both in France and in England, during the last ten years, has been mainly ascribed to the machine invented in France by M. Jacquard; and the powerful impulse thus given has been assigned to the *Jacquard Loom*. This loom is stated to perform all those labors which had heretofore been exclusively confined to the most skilful hands, with important economy of time and labor in the preliminary steps, and is so decidedly superior to all other looms, for all the curious varieties of figure-silk weaving, that it has superseded them all, both throughout France and England.

Those resources, the millions we now annually expend for silks, the productions of foreign industry, and of foreign policy, draining our country of its treasures—those vast sums should be preserved to our citizens. This industry and resource of wealth must not be compromised nor bartered, nor sacrificed to rival and particular interests, or to the interests of rival nations. The cultivation of silk being in no wise exclusive, but a great and general interest, alike adapted to every region of our country, from the north to the extreme south; from the Atlantic to our territories which are bounded on the Pacific ocean—it demands that equal share of protection which has been bestowed on cotton, on iron, on tobacco, and on the productions of the sugar cane. But the encouragement of the cultivation of the mulberry, and of the growth of silk, *in the United States, as a resource of Agriculture*, seems not to have formed any part whatever of what is called the "American System."

The enterprise, the fertile invention, the noble efforts of individual exertion, have already accomplished much, but the field is very broad and of vast extent; much yet remains to be done. That industry which still slumbers: that portion, which unawakened is now lost, being alone more than sufficient to accomplish all, if once aroused and rightly directed—more than sufficient to recover again those very con-

siderable sums, the millions so prodigally expended, with interest an hundred fold.

By those unceasing toils and mighty efforts, and matchless labors, for which our people are so distinguished, the millions thus recovered will not only be their just reward, but will add to the substantial wealth of the nation, and to the glory of the whole Republic. * * *

In our own country, there may yet perhaps be some who would advance the question whether this most desirable plant will endure the winters of northern climates. At New-York, on Long Island, this mulberry has sustained, unprotected, the rigors of seven winters, as I am informed, and the extraordinary winter of 1831–2, which destroyed so many trees hitherto deemed hardy even to the root.

I have indeed sanguine expectations, that the *Morus Multicaulis* may prove as hardy in our climate as the peach tree, which was originally from Persia, or the cherry tree, when once their roots have become established. Its vegetation being rapid and luxuriant, and prolonged to a later period in autumn than that of most other trees, or till the tender and yet vegetating tips of the twigs are checked by the frost, these extreme ends will generally be lost, as they always are of the common White Mulberry when young.

In our climate, there are many kinds of trees which need protection during the first winter, though they may never require any afterwards. Such are the young seedling plants of but a single summer's growth, of the *Cherry*, *Plum*, *Pear*, the *Quince*, and the *White Mulberry*, &c. all which require to be carefully, compactly placed in cellars; during winter, their roots buried in soil; or occasionally, for protection, may be laid in out of doors compactly and in a slanting position, their bodies being in part protected by soil. For all these species are liable to be killed occasionally to the root by the first winter, or to be utterly destroyed by being thrown out by frost, yet in the second winter it is far otherwise; their roots becoming strong and firmly established, the well ripened wood of the second year, and the wood of two years' growth becomes indestructible by any but very extraordinary winters. I have taken the same precautionary measures with the young and tender plants of this mulberry, so valuable—the layers of but a single summer's growth, which are separated in autumn.

I will offer some further evidence of the hardihood of this plant. But the experiments which are now in progress elsewhere, as well as here, on a more extensive scale, will, as I trust, soon enable us to put this subject more fully at rest.

Very late in the spring of 1833, more than an hundred young trees of the Morus Multicaulis were set out on the place of S. V. S. Wilder, Esq. in Bolton, Worcester county. The soil springy, the exposition cold, and sloping to the north; Mr. Joseph Breck, a distinguished botanist of Lancaster, the town adjoining, having especial charge of these plants, has lately very critically examined them. Thus unfavorably situated, and unprotected, they have borne the last winter without injury, except only the very tips of the twigs. Mr. Breck is persuaded that they are even hardier than the common white mulberry, since some hundred of the latter, which stood very near, were killed half way down to the ground by this same winter.

I have just received a letter, of the 30th ult., from John Gordon, Esq. a public spirited gentleman, who has, during the last year, made trial of the *Morus Multicaulis*, at Hampstead, N. H. These plants grew well during the summer and have borne well the winter, and are now luxuriantly vegetating to within two or three inches of the tips. Mr. Gordon is now making trial of the white mulberry, and the *Morus Multicaulis*, in the city of Portland, in exposed situations, also of the silk worm, confident they will all succeed well, and that the culture of silk will answer well in that climate.

Although the mulberry flourishes most luxuriantly in a moist and rich soil, and protected situation, yet the leaves in such soils and situations are more crude, and not of a quality so nourishing. Besides, the growth of the tree in such situations being much more rapid, the wood is consequently more tender and more liable in northern climates to be killed by winter; and authors seem to be agreed, that the proper soils for the mulberry tree are dry sandy, or stony; and trees on dry light soils, and situated on the open plains, and on hills the most exposed to cold winds, will generally be found to suffer least of all from the effects of winter. Such appears to have been the case in 1831–2; the ravages of that destructive winter seem to have been generally confined to trees growing in particular situations and soils. Even delicate trees and plants, the natives of more southern climes, become more hardy, and capable of supporting the northern winters, by being planted on the north side of buildings and fences, and in their shade. The exposure to the most intense degree of cold, in such situations, is more than compensated by the protection which is thus afforded to the plants during winter, from the pernicious and far more destructive rays of the sun.

The prediction, in 1830, of the late Dr. Felix Pascalis, that, "after the discovery of *this plant*, a doubt no longer exists that two crops of silk may be produced in a single season;" this prediction has since been fulfilled—its truth confirmed by experiment—the soil and cultivation, the habitations for the successive generations of insects being yet the same: all thus converted to a double use, and the whole production doubled. It must be obvious, that the actual profit thus augmented must be manifold.

Newton, June 7th, 1834.

To remove a Hard Coating or Crust from Glass and Porcelain Vessels. — It often happens that glass vessels, used as pots for flowers and other purposes, receive an unsightly deposit or crust, hard to be removed by scouring or rubbing. The best method to take it off is to wash it with a little diluted muriatic acid. This acts upon it and loosens it very speedily.

ASTOR'S HOTEL.—The corner stone of this fine building was laid on the 4th of July at 6 o'clock A. M., in the presence of about a hundred spectators. A box was deposited beneath the stone, with a silver tablet in it, containing the following inscription :

CORNER STONE OF THE PARK HOTEL.
Laid the 4th of July, 1834
The Hotel to be erected by John Jacob Astor.
BUILDERS,
Philetus H. Woodruff, Peter Storms, Campbell & Adams.
SUPERINTENDENTS,
Isaiah Rogers and *Wm. W. Barwick.*
ARCHITECT,
Isaiah Rogers.

The daily papers of Thursday, the last number of the Mechanics' Magazine, containing a full length portrait of Lafayette, and "Goodrich's Picture of New-York," were also deposited in the box.

The dimensions of the building are as follows: The length of the building, fronting Broadway, will be 201 feet 1 inch; fronting Barclay street, 154 feet; fronting Vesey street, 146 feet 6 inches. There are to be six stories: the height to the top of the cornice will be 77 feet. In the centre there will be a court yard, measuring 105 feet by 76. Each of the fronts will be built of *blue Quincy granite*. As the principal entrance will be from Broadway, there will be four columns—two of the Doric, and two of Attic—surmounted with entablature.

Questions on Mathematics—Reply to Mr. Caryl, of Buffalo. To the Editor of the Mechanics' Magazine.

SIR,—Want of time has prevented me hitherto from noticing a communication from Mr. L. W. Caryl, of Buffalo, which appeared in the New-York American last July. There was a faint attempt towards a solution of the questions proposed him by me; the answers to the previous questions were wrong, and I pointed out to him the errors; still they were disregarded, and nought but a bag of wind substituted in place of solutions. In return for which, I propose to send him on the solution to the questions proposed, if not done within the specified time, and stand ready to solve any question proposed by the gentleman, and send the solution by the return mail. As he complained of a want of fair play in the New-York papers, he may name any paper in Buffalo, for the purpose of inserting the questions or solutions. JNO. D. WILLIAMS.

SCIENCE AMONG THE ARABS.—It is unquestionable that a great number of the inventions which at the present day add to the comforts of life, and without which literature and the arts could never have flourished, are due to the Arabs. They taught us the use of the pendulum in the measurement of time; and also of the telegraph, though not with all the speed and effect of modern improvement. The manufacture of silk and cotton was brought by them into Spain, as was probably the art of dying black with indigo. They introduced the use of camels and carrier pigeons into Sicily. The art of enamelling steel, the system of a national police, the principles of taxation, and the benefits of public libraries, were all derived from the same source. To them also belongs the honor of making us acquainted with the manufacture and use of paper. This invaluable commodity, it is true, had from a very remote period been made in China from the refuse of silk, bamboo, and other substances. About the year 649 the invention was introduced at Samarcand by the Tartars, who used cotton instead of silk; and when that flourishing city was subdued by the Moslems, the process was conveyed to Mecca, by Yussuf Amru (A. D. 706), where paper was made similar to that now manufactured, though it does not appear to have come immediately into general use. From Mecca the art spread through all the Arabian dominions. In Spain, which was renowned for this article from the 12th century downwards, flax, which grew there abundantly, was substituted for cotton, the latter being scarce and dear. Alphonso X. established paper-mills, and his example passed successively into France, Germany, and England. Gunpowder, the discovery of which is generally attributed to Schwartz, a German chemist, was known to the Arabs at least a century before any traces of it appear in European history. Though it is probable they may have derived their knowledge of this composition from the Indians, they certainly improved its preparation, and found out different ways of employing it in war. The mariner's compass has been alternately given to the Italians and the French; but Tiraboschi, notwithstanding his partiality for his country, is decidedly of opinion that the honor of its invention is due to the Arabs. Its adoption in Europe is not older than the 13th century, while among the Arabs it was known in the eleventh. The polarity of the magnet is alleged to have been known to Aristotle; and something like the compass was in use among the Chinese; but as the Saracens paid considerable attention to navigation, and often undertook long and laborious voyages, history has with much probability assigned to them the discovery of the magnetic needle.

The Mechanics' Magazine and Register of Inventions and Improvements is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 26 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1 75—or at $3 per annum *in advance*.—THOS. KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

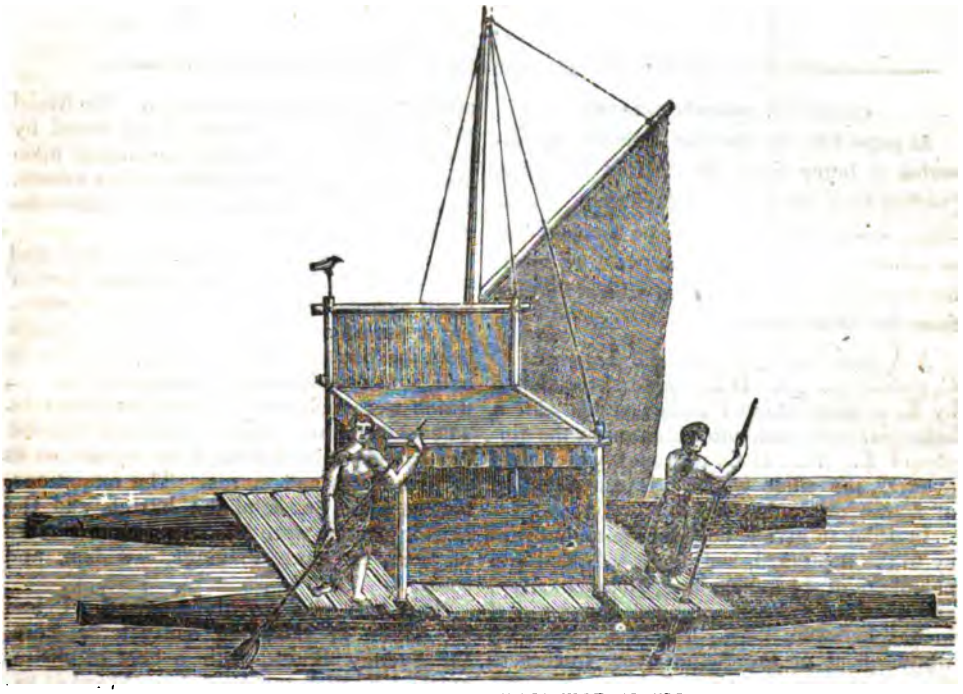
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

Volume IV.] FOR THE WEEK ENDING JULY 26, 1834. [Number 1.

"Science distinguishes a genuine hero from one of those athletic brutes whom, undeservedly, we call by the honorable name. Cursed be the poet who first honored with the title of hero a mere Ajax, a man-killing idiot."—DRYDEN.

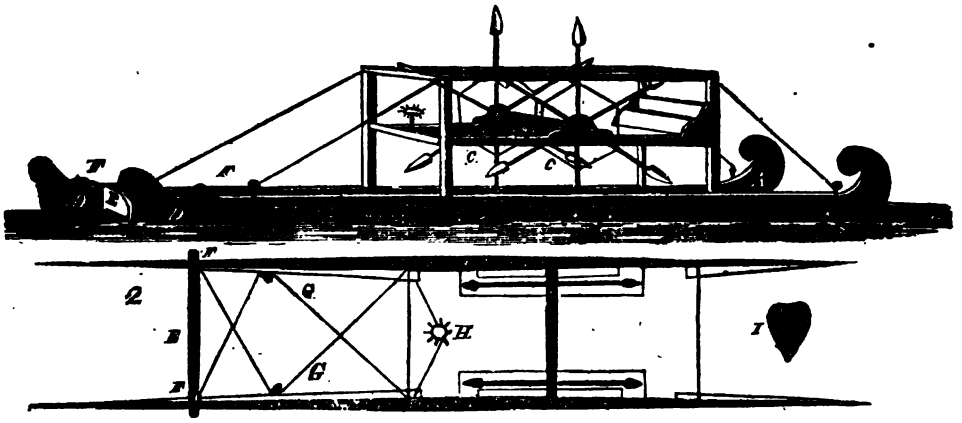
NEW ERA OF STEAM POWER.



A DOUBLE CANOE OF THE FRIENDLY ISLANDS.

The great utility of Mr. Burden's plan, or invention, or adaptation to navigation, (we hardly know what to call it,) has called forth a host of competitors, all desirous of proving that they had the same plan already prepared to come out with when an opportunity should occur which they might consider advantageous. We insert Mr. Canning's claim, and shall, next month, insert some others, introducing now an engraving, handed to us by an esteemed friend, of a boat in use at the Friendly Islands, so long ago as 1798, of a similar construction. It is copied from an engraving in Labillardiere's account of a voyage in search of La Perouse, the French traveller. Monsieur Labillardiere states that a great number of the natives came out to them in boats constructed in a similar manner.

PROGRESS OF STEAM NAVIGATION WITH INDIA.—A steam voyage from India to England, by the Red Sea, seems at last to be really on the eve of taking place. The steamer Forbes has been engaged to start from Calcutta for Suez, the Hugh Lindsay having been pronounced unfit for the purpose. The whole expense, except that of the coals, is to be borne by the Indian Government; while the Calcutta Steam Navigation Committee, will receive all the profits on passengers and all kinds of freight, except letters, the postage of which will be reserved by the Government.



CANNING'S DISPATCH-RAFT.

At page 338, in our last volume, we inserted a letter from Mr. Alfred Canning, (copied from the London Mechanics' Magazine,) asserting his claim to be the inventor of a boat on Burden's plan; we now insert his drawing and description, which we take from the same source.

A A represent floaters. B, the deck. C C, paddle wheels. D D, rudders, connected by E, a board about 7 inches wide, with a hole near each end, into which insert the nipples, F F. F F, G G, till ropes, which pass over H, the tiller wheel. I, cross-section of floater or trunk.

In order to give a due degree of buoyancy to the floaters, I had them hollowed into chambers of 14 inches long, 10 inches deep, and 4 inches wide, leaving solid parts of 3 inches between. This raft was destroyed while afloat on the Seine river, (owing to the culpable negligence of the person who had it in charge,) by a loaded barge, which came in violent contact with it. I shortly afterwards constructed another upon the same principle, but much larger, and instead of floaters, similar to the first, made use of troughs formed of half inch deal boards, which I found also to answer well. When my raft was almost finished, as I was one day trying its rate of going, opposite the Champs Elysees, in company with a friend, and my little son (about three years old), a French steamboat, on board of which was the proprietor and a large party, evidently quitted its original course, dashed with tremendous force upon the starboard quarter of the raft, and broke it up in a twinkling, submerging the deck, upon which the child was placed, who, but for instant vigorous exertion, would, with my friend, have been drowned, as the current runs with extreme rapidity in that part of the river. My friend and the youth were received on board by the steamer. I preferred remaining upon the wreck, which I with difficulty got ashore, at a considerable distance from where the collision took place.

I soon after re-constructed my raft, and substituted for the troughs a double row of small barrels, twenty-eight in number, varying in size, placing the largest the fourth from the bows; these I boarded over with half inch deal boards, forming long staves, which were screwed down to the barrels. The ends of the boards projected beyond the barrels at both ends of the trunks, so as to form stems and sterns. The interstices, between the heads of the barrels and the outside planks, were filled up with a mixture of pitch, tar, cork shavings, saw dust, and resin.

This raft was greatly admired. I had the honor of receiving our veteran hero, Sir Sydney Smith, with a host of distinguished English and French, on board at various times, who all seemed to approve highly of the principle upon which it was constructed—considering that it would insure personal safety in an eminent degree, as it was neither liable to sink nor upset, while its rate of going was much greater than any other sailing craft, and it afforded an incomparably more commodious place for passengers than a boat of ordinary build.

I next contemplated the construction of a still larger raft, to be propelled by steam, but, for the reasons already assigned in my former communication, I was not able to procure permission from the Prefect of the Seine. I soon afterwards sold my raft to Colonel, now General Trobriand, and Mr. Mallet, to run as a pleasure raft upon the celebrated lake of Montmorency.

The 20th of last December, (consequently prior to any account of the raft construct-

ed by Mr. Burden being received in this country,) I commenced the construction of a small raft of the kind for my own use, to run upon the Thames. It is almost finished, and would have been some time back, but for circumstances not connected with the affair. I remain, sir,

ALFRED CANNING.

Crown Coffee-House, Holborn, April 17, 1834.

BURDEN'S BOAT.—We accompanied Mr. Burden in his first trip in his new boat to Albany and Troy, on the 7th of July: the boat left the foot of Courtlandt st. at 22 minutes past 7 o'clock. The Erie, which is considered the fastest sailer in the line, was then from four to five miles ahead. Mr. B. continued gaining on the Erie until he nearly reached Catskill, and in a very few minutes would have passed her, but for an accident that occurred to the machinery. The lever of the cut-off-steam valve gave way, and the consequence was a great waste of steam, and reduction of the revolutions of the wheel from 23½ of a ten-foot stroke to 16. Mr. B. finally stopped the boat, and with the assistance of Mr. Snodgrass, Civil Engineer, of Glasgow, (who had the direction of the construction of the cast iron packing, and suggested other alterations that have been adopted,) repaired it, but not so well as to enable Mr. B. to regain the speed he was previously going, namely, about 19 miles an hour.

The time lost in repairing it, and the difference of the speed in consequence of this accident, may be estimated at about three hours—still the boat reached Troy in less than an hour after the Erie. Had the machinery worked well, Mr. B. fully calculated to have made the passage in nine hours.

Mr. B. is about building another boat, 100 feet longer than his present one, the parabolic spindles of which are to be of iron.

The engine was made at Mr. T. B. Stillman's manufactory, Novelty Works, Dry Dock, in this city.

Mr. B., accompanied by numerous friends, has since made another excursion, from Troy to Hudson, and accomplished 18 miles in 65 minutes. He is making some further improvements, which will delay its starting in the regular line two or three weeks.

REPLY OF C. HARRIS TO ARCHIMEDES.

To the Editor of the Mechanics' Magazine:

SIR,—I would, through the columns of your Magazine, inform Archimedes that his "solemn protest" against entertaining any disposition to wound my feelings in a preceding communication, is, as far as I understand that production, entirely gratuitous, although he, no doubt, best knows what his own intentions were. It may be "some alleviation of his trouble" to understand, that unlike a late celebrated protest, it has had the effect only to add to the "no little amusement" which his former communication afforded. Whatever wit lies concealed in his remarks respecting the disturbance of my intellect, being altogether beyond the ken of that intellect, will, for that reason, I trust, form my apology for saying nothing further on that point.

Whether the admission into your Journal of my last communication did or did not operate to the "exclusion of interesting matter from a succession of pages of the Magazine," is a point which the readers thereof will no doubt decide for themselves. Agreeing with A. in his estimation of it, I certainly had not the presumption to think it was very interesting matter. My object evidently was merely to defend myself from what appeared to be the act of an honest, generous opponent, who, deeming me to be in error as to my own invention, (it must be admitted on rather slight premises,) undertook to set me right. As to the *delicacy* and *force* of such remarks as are contained in the immediately preceding quotation from A., I will merely assure him, that to the *exclusive* use of such weapons, and to all the advantages which they can afford him, he is entirely welcome.

Archimedes doubtless well knows, that in my last communication I distinctly state, that "I do not by any means rest on this difference in proportions as a proof that my invention is one *sui generis*, and not identical with Mr. F.'s boat;" and that I then proceeded to describe the most essential points of difference.

With these facts staring him in the face, he has the ingenuousness, the "magnanimity," in the third paragraph of his last communication, to make it appear as if a difference in proportions is the only distinctive mark of my invention as compared with Mr. Fairman's boat.

I have been vain enough to believe that I

possessed a somewhat correct idea of that quality of the mind termed "magnanimity;" but I find to my sorrow that I labored under a mistake, and would here thank Archimedes for the correction; but I would have it understood that I must be allowed the exercise of my own discretion as to the practice of *such* magnanimity as he exhibits *par example*. As a slight reciprocity of the favor, I would tell Archimedes that any ship-builder's *apprentice* will inform him that the term "fine," when applied to the forms of vessels' extremities, with reference to any peculiarity of model, as was evidently the sense in which I used it, means something very different from "finery." Was it magnanimity, or was it that *other quality*, in this case the only alternative of the former, which caused A. to give a meaning to the term "fine" so *outre*, so foreign from its true signification?

Archimedes says I have "misunderstood him in some trifles," adducing as an instance the *gain* resulting from the swelled sides. He says in his latter, as in his former communication, that the "*gain** in speed, with the same power, was from 4 to 6 miles per hour;" and in proof of that assertion, proceeds, (with what arithmetical consistency I leave others to determine,) to state, "that is, she would go but four miles before the *swell*, and she went six miles afterwards." !! A *boy* now, as I write, at his employment in my counting-room, says that from the above premises the gain could have by no possibility been so much as "from 4 to 6," but only 2 miles. If I have not forgotten my arithmetic, I will venture to say he is right, and that could the shade of the *real* Archimedes rise before him and hear him repeat the assertion of the *American* Archimedes, he would in my opinion be very apt to recommend that boy's return to the pedagogue, to receive, as his first lesson no doubt, a speedy application of a quantum sufficit of birch.

We must all admit that Archimedes' mode of explaining his expression respecting the gain is admirably ingenious, worthy of his *name*. Newspapers contain few phrases more common and well understood, than such as the following, namely, "The profits resulting were from 4 to 6 per cent.;" "the article has advanced from 4 to 5 per cent.;" "from 4 to 4½ per cent. is confidently calculated on;" all three of which expressions, any country lad knows, who reads in a paper the prices of produce, mean neither of them less than 4 per cent. *gain*, advance, or profit, as the case may be. Adopt Archimedes' rules of analysis, and we have two per cent. as the profit in the first case, one per cent. as the advance in the second, and only one half per cent. in the latter case.

Sage of Syracuse! where was thy mantle when thine own son, in this age of degeneracy, threw out, under the protecting ægis of thy name, these portentous *new-lights*, threatening sudden destruction to the long established principles of thy favorite pursuits?

But to respite Archimedes' famous *solution* of so plain, so very common, and well understood a phrase, as is used by him to express the gain, still it of necessity results, from the original speed, 4 miles, and the improved speed, 6 miles, as are now given by him, that the *swell*, namely, "the angle of *resistance*," (the very words of A. in relation to the inner curves,) conferred a gain of 50 per cent.!! *Credat Judæus!* and so may Archimedes, no doubt, in all sincerity; but, sir, I cannot constrain my mind to admit every startling proposition brought before it, even if others, with "*names* of learned length," happen to believe it.

In some cases, and this from its nature is one, (without any implied disparagement to A. and his friend,) sound and sufficient reasoning is requisite to convince the understanding, and I would therefore humbly beg Archimedes, (surely his pride of name will not allow a refusal,) to demonstrate, for the benefit of my obtuse "intellect," how that which, as soon as applied, is in itself "an angle of *resistance*," an obstruction; can, merely by the application thereof, diminish resistance which itself alone creates—remove obstruction, an effect of which it is the cause, or in any way add to that speed which from its very nature it must be at the same time retarding.

Archimedes states that "Mr. F. *supposed** that as the water was thrown back from the wheel, by giving it a diverging passage, it would leave the boat more freely," and remarks "perhaps he was wrong." A. requires only a little practical acquaintance with the subject to become perfectly convinced, that, however plausible this divergency may appear on paper, it is quite another affair in water.

I am informed by A. that "there are times when there is not a six-knot sailing breeze in the sound, and that perhaps Mr. F. took such a time." It appears from the text that Mr. F. made *several* trips, carrying passengers. "Perhaps" also, old fathers

* Italicised by C. H.

* Italicised by C. H.

Neptune and Æolus were induced to form a coalition, and mutually engage that there should be no troublesome *swell* kicked up on the several days appointed for the running of Mr. F.'s boat. After A.'s display of the new-fashioned magnanimity, I cannot, of course, rely upon his candor as to admitting the correctness of my "statements" referred to by him, and therefore must, of course, forever lament that my invention cannot obtain the immortalizing approbation of one whose powers of "intellect" are so transcendently great as to make a "*gain* of from 4 to 6 miles" expressible by the numeral digit 2.

A.'s assumption that he has been a source of trouble to me, however indicative it may be of a little harmless vanity, is equally gratuitous with his solemn protest; for I can assure him, as I have already done, that he has literally amused me, amused me only, and that whether I "hear again" from him or not is a matter of indifference to me, and a point which I leave entirely to his own discretion.

I remain, sir, very respectfully, yours,

CHARLES HARRIS.

Norfolk, Va., July 1, 1834.

AERIAL STEAMBOAT.—We find the following in the Cincinnati Daily Gazette.

Mr. Editor,—Perhaps it is not generally known, that one of our ingenious citizens has invented, and has now in preparation, the *model* of an *aerial steamboat*, in which he proposes to ascend.

Although but little expectation of the success of the experiment is entertained by the writer of this article, it is worthy the attention and examination of the scientific. The inventor, Mr. Mason, is very sanguine, having already made (to him) a satisfactory experiment.

The boat is about ten feet long, the ribs being covered with silk, in order to render it very light. The engine, of two horse power, is placed in the middle, and turns four vertical shafts projecting over the *bow* and *stern*, into each of which are fixed four spiral silken wings, which are made to revolve with a sufficient velocity to cause the vessel to rise. Over the whole is fixed a moveable silken cover, designed to assist in counteracting the gravitating force, at the same time tending to assist in its propulsion forward.

The whole boat, including the engine, weighs 60 pounds, and has cost about $300. it is the design of the *inventor* to *attempt* an aerial excursion, of which due notice will be given. J. L.

SUCCESS OF STEAM-CARRIAGES ON COMMON ROADS.—These wonderful machines are now constructed with sufficient mechanical skill, amount of power, safety, and general efficiency, to insure their successful employment on any good road; and it is certainly time for our capitalists to turn their attention to them as legitimate objects of support, and as offering the means of a profitable investment. From the earliest developement of the capabilities of steam, as applicable to purposes of locomotion, on properly constructed roads, we have carefully watched the progress made by different inventors, and have on many occasions borne testimony to the unceasing efforts of two of the most persevering and deserving among them: of two who have from time to time promised less and performed more than any of their contemporaries—we mean Col. Maceroni and Mr. Hancock. On Saturday we had a trip on the Edgeware road, with the second coach constructed by the gallant Colonel. Starting from the Paddington Wharf, No. 19, we proceeded on the road in the most surprising style, the coach being turned, checked, stopped, or having its speed increased, under the complete command of the conductor. About three miles out we passed a stage coach, whose four horses were put to their utmost speed, with a comparative velocity to that with which the stage coach would have passed a waggon, our rate being at that time about 18 miles an hour. Soon after this we ascended Windmill-hill with perfect ease; although, in consequence of the road undergoing repair, the part we had to ascend was cut into deep ruts, and covered with dry soil and dust from three to six inches deep—forming, perhaps, the most uncertain and disadvantageous fulcrum on which the wheel of a steam carriage could ever have to act. We arrived at the Welch Harp Inn, which is several perches over the five miles from our starting place, and turned the coach in the direction of Paddington, in precisely twenty minutes; having performed the distance, inclusive of stopping at the turnpike and on two other occasions, and despite the bad condition of Windmill-hill, at the extraordinary average rate of fifteen miles an hour. Our return occupied the same period of time; and after this completion of the trip, we made the round of Paddington Green to gratify some gentlemen who had not arrived in time to witness the more extensive trial. Among our fellow-passengers on these occasions were Jerome Buonaparte, ex-king of Westphalia, Prince Jerome his son, the Duke de Montfort, the Marquis Azolino, M. Vigne de Marveille, and other distinguished foreigners.—[London Morning News.]

Col. Maceroni has addressed the following letter to a morning paper:

Sir,—You certainly have made a mistake in saying that the coach, on Saturday last, went at eighteen miles the hour, when it overtook and passed the stage, whose four horses were "put to their utmost speed, with a velocity comparative to that with which the stage coach would have passed a waggon."

Wyatt, of the Watford and Aylesbury coach, the one to which you refer, is very angry at your asserting that his fine team of horses were overtaken and passed in the manner you speak of by the steamer, when the latter did not perform more than 18 miles the hour! Wyatt knows the steamer well; he was once beaten by it going up Windmill-hill; and he says—and I say—and all the others say, that when the steam carriage overtook him, and passed him on Saturday, it was undoubtedly at a pace of more than 24 miles the hour.

We have many times done two miles in five minutes, and you shall see it done again whenever you are so disposed.

You show that the speed of the whole ten miles, including several stoppages and the turnpike, &c., was above fifteen miles the hour. Surely to overtake and pass a team of four fine horses at their "utmost speed," as we did, must have required more than eighteen!

But to set the matter at rest in your mind, I will keep a seat for you in the carriage on an occasion which will offer in a few days, of putting to the test, at their utmost speed, a chosen team of horses, a fourteen mile heat, on the most hilly and softest road out of London. I have the honor to be, sir, your most obedient servant, FRANCIS MACERONI.

Wharf 19, Paddington Green, May 26, 1834.

On the Phenomena of Flame. By J. O. N. RUTTER, ESQ. [From the London Mechanics' Magazine.]

"As in mathematics, so in natural philosophy, the investigation of difficult things by the method of analysis ought ever to precede the method of composition. This analysis consists in making experiments and observations, and in drawing general conclusions from them by induction, and admitting of no objections against the conclusions but such as are taken from experiments, or certain other truths. For hypotheses are not to be regarded in experimental philosophy."—[Sir Isaac Newton.]

The design of the following paper is to bring together a variety of experiments which may be considered as illustrative of the phenomena of flame. By applying to them the canon of philosophical research so beautifully described by Newton, we may, perhaps, arrive at conclusions at once instructive and satisfactory. It is very agreeable, and sometimes very convenient, to take shelter beneath the influence of great names. This love of ease, when the investigation of an intricate subject is concerned, tends very often to perpetuate error. Whenever acknowledged difficulties present themselves, they ought to be fairly met, rigidly examined—and, if possible, immediately removed. A course the very opposite to this is frequently pursued by very excellent and very learned men; among whom are some of the most popular scientific writers of the present day. With book-makers it is a common practice to transfer the opinions, and, in many cases, the very words of others, to their own columns, without examination; and, not unfrequently, without acknowledgment.

As the papers of Sym and Davies on flame, referred to by Dr. Thompson, in his Treatise on "Heat and Electricity," 8vo. London, 1830, p. 310, are not accessible to me, I have no means of ascertaining whether the following experiments have or have not been already described. If I have been anticipated in the whole of these investigations,* I can see no reason for rejecting or undervaluing, on that account, the information they supply.

1. If a piece of wire-gauze be brought down gradually upon the flame of a taper, or candle, the section of the flame, when viewed from above through the wire-gauze, will appear as a ring of light surrounding the wick, but not in contact with it.

2. A jet of coal gas will present a similar appearance. The orifice of the jet may be very distinctly seen in the interior of the flame.

3. If the wire-gauze be brought down in the way already mentioned upon a flame of coal gas, issuing from an Argand burner, the section of the flame will exhibit two distinct rings of light, and the thickness of the burner will determine the distance between the rings.

4. If an Argand lamp, with a wick supplied with oil, be employed, the thickness of the wick will determine the distance between the rings.

5. When the air is excluded from the interior of an Argand burner, the flame, whether it be that arising from gas or oil, which was previously cylindrical, assumes a conical form. Let the wire-gauze be brought down upon this flame, and there will be, as in the case of the taper, or the jet, (1, 2,) one ring of light corresponding with the exterior surface of the wick, or burner, (3, 4.)

6. The flames of alcohol, and of hydrogen gas, present in every respect the same phenomena as those described (1, 2, 3, 4, 5,) excepting, of course, in the quality of the light.

7. Phosphorus, if inflamed in contact with the atmosphere, and the wire-gauze brought down upon it, exhibits a ring of light. The experiment requires a little caution and dexterity. The opacity of the interior of the flame may, however, be very distinctly recognized.

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* I observe that Mr. Watson, Mechanics' Magazine, No. 551, page 362, has anticipated one of my experiments. I am hence induced to hold them all with a loose hand.

8. If we take about three fourths of an inch of wax taper, insert it in a piece of glass tube the same length, employing as a foot to the taper so inclosed a disc of cork, sufficiently large to keep it steady; then, in a saucer or evaporating dish, coil some filaments of lamp cotton, so as to form a ring about two inches in diameter, and three fourths of an inch in height; saturate the ring of cotton with alcohol, light the taper, place it in the centre of the ring and inflame the alcohol, the taper will be extinguished. The heat in the interior of the flame of the alcohol will be sufficiently intense to vaporise the wax, which vapor will be decomposed and inflamed at the summit of the alcoholic flame, imparting to it a characteristic brilliancy; but the wick of the taper will not be inflamed if the process be properly conducted. To insure success in this experiment, we must guard against any agitation in the surrounding atmosphere, by moving about the room, opening or shutting doors, or breathing too freely in the immediate vicinity of the alcoholic flame. After observing all these precautions, we shall probably find that the flame will be in a continued flutter, occasioned by a current of rarefied air, and the taper will be alternately extinguished and relighted, just in proportion as the unsteadiness of the flame prevails or subsides.

9. Instead of a taper (8), if we place a piece of phosphorus in a small metallic spoon,* inflame it and pass it into the interior of the alcoholic flame, the phosphorus will be extinguished; suddenly withdraw it, it will inflame; pass it again into the interior, and it will again be extinguished.

The phosphorus, as already remarked of the taper, may be vaporised; and the vapor will become luminous as it enters into combination with oxygen at the summit of the alcoholic flame. Should it happen that the phosphorus has not been properly dried, small particles of it will be thrown out on every side: these will inflame the instant they come in contact with the external atmosphere.

10. We may vary this experiment by placing in the interior of the alcoholic flame (9) a small metallic cup,† containing alcohol, ether, or spirit of turpentine. These materials may be vaporised, but they will not flame in the cup as long as the alcoholic flame preserves its conical form.

11. If phosphorus (9) be placed in the centre of the flame of an Argand burner, (3, 4,) to which atmospheric air has access, it will inflame. If the further ingress of air be prevented, the flame will become conical (5), and the phosphorus will be extinguished.

12. The result will be still more instructive, if we repeat the last experiment in an Argand burner supplied with coal gas, the ingress of air to its interior being prevented. Let the phosphorus be ignited and passed into the interior of the gas flame, the phosphorus will be extinguished. Turn off the gas, the phosphorus will be inflamed; turn on the gas, that will be inflamed, whilst the phosphorus will be again extinguished (10). If we employ alcohol, ether, or spirit of turpentine, in an Argand burner, supplied with oil, or coal gas, the results will be more uniform and satisfactory than with a large flame of alcohol, for the reason already stated (8).

13. A lighted taper placed in the interior of the flame of an Argand burner will continue to burn so long as air has access to it: exclude the air (5), and the taper will be extinguished. We may vary this experiment by employing a jet of coal gas instead of the taper. The result will be the same in both cases.

14. If a coil of platinum wire be held above the flame of alcohol, the wire will become incandescent. If we pass the wire into the interior of the flame, its incandescence will cease. In this experiment the effect will be more intelligible if we employ a spirit lamp with an Argand wick. The incandescence of the wire may be determined or prevented, by the admission or exclusion of air (11).

15. Instead of an Argand wick we may employ a common fibrous wick of cotton, say one inch in diameter, and it may be supplied with tallow, oil, or alcohol. The phenomena will be the same as those already described (5, 8, 9, 10.)

16. If a stream of oxygen gas be projected from below into the interior of a conical flame (5, 6, 15,) we shall observe the unusual phenomena of one flame within another.

17. A stream of oxygen gas, or of atmospheric air, projected upon any of the materials before mentioned, viz. phosphorus, ether, alcohol, spirit of turpentine, a jet of coal gas, or a taper, will produce an inflammation; but the inflammation will continue in the respective materials only so long as the supply of gas, or of air, is maintained.

18. If any of the materials just enumerated be placed in actual contact with the flames of tallow, oil, alcohol, or gas, whether

* A spoon for this purpose may be conveniently formed by flattening one end of a piece of copper wire.

† For cheapness and convenience, say part of a child's thimble.

interiorly or exteriorly, inflammation will ensue; but the combustion of the respective materials will be less perfect and less energetic when enveloped in the flame of some other body than when they are inflamed, under ordinary circumstances, in contact with atmospheric air.

19. The flame of an explosive mixture of coal and oxygen gases is of a pale blue color, and the greater the proportions of oxygen, within the limits of saturation,* the smaller is the flame, and the fainter is its hue, as compared with an equal volume of coal-gas when burning in the usual way. Similar phenomena present themselves in an explosive mixture of coal gas and of atmospheric air. In the latter case, the color of the flame is somewhat deeper.

20. It is almost unnecessary to remark, that the flame of an explosive mixture of oxygen and hydrogen gases is of so pale a color as to be scarcely perceptible in daylight. This is not its most remarkable quality.

21. If a stream of hydrogen gas be ignited at the point of a jet, by bringing down upon it a piece of wire-gauze (2), we may ascertain that the flame is hollow. If a stream of oxygen gas be projected from a similar jet, in the same direction, and in immediate contact with the hydrogen, we shall find that, notwithstanding the additional supply of gas, (the proper proportions being half a volume of oxygen to one volume of hydrogen,) the flame will be immediately very sensibly diminished in size, and it will no longer appear hollow. Further: in the flame from hydrogen alone, the greatest intensity of heat will be found near to its extremity, at the apex of the cone. It is not so with the oxy-hydrogen flame—the point of greatest intensity in that being near the base of the cone, where the greatest quantities of the two gases first enter into chemical union.

22. The analysis of coal gas teaches us that when it is of good quality, (sp. gr. 475 h. 550,) each volume will require for its complete combustion nearly two volumes of oxygen: one volume of oxygen, combined with an equal volume of carbon, producing carbonic acid; the other volume of oxygen, by its union with two volumes of hydrogen (condensed into one volume as it exists in carburetted hydrogen,) forming water.

23. The analysis of coal gas also enables us to understand the habits of explosive mixtures, and especially those of carburetted hydrogen (fire damp) and atmospheric air. Thus, when the relative proportions of inflammable gas and of air are as one volume of the former to five volumes of the latter, the mixture is not explosive; but if the quantity of air be gradually increased from five to ten, or even twelve volumes, the mixture detonates with increasing violence at every additional volume of air, up to the point of saturation.*

24. That mixtures of explosive gases, whose relative proportions are adapted to form most readily new compounds, will detonate with the greatest violence; and *vice versa*.

25. Explosive mixtures of coal gas, or carburetted hydrogen, and of oxygen, are subject to the same laws as mixtures of the same inflammable gases with atmospheric air. The former explode more uniformly and more promptly than the latter. This is a result we may expect, since in the former instance the particles of inflammable gas and its supporter must be in more intimate union than can possibly happen in the latter instance, through the interference of the azotic gas present in atmospheric air.

26. Those mixtures of explosive gases inflame the most readily through narrow tubes, and the interstices of wire gauze, whose relative proportions are best adapted for forming new compounds. We have no difficulty in understanding how it is that explosive mixtures inflame so readily in narrow tubes and in close vessels, if we bear in mind that the elements of combustion are arranged, in such mixtures, under the most favorable circumstances; and hence they require no aid from fresh accessions of oxygen externally applied.

27. If we apply a blow-pipe to the flame of a candle, a lamp, or a jet of coal gas, we shall find a greater intensity of heat will be obtained by projecting a stream of air across the flame near its base, than by projecting

* I employ this term for want of a better. By the limits of saturation, I mean those proportions of oxygen with coal gas most favorable to inflammation or explosion.

* See preceding note. As a familiar illustration of these phenomena, we may suppose 100 cubic inches of coal gas to be mixed with 500 cubic inches of atmospheric air. The mixture will not be explosive, because it will not contain a sufficiency of oxygen to support its inflammation—500 inches of air containing only about 100 inches of oxygen—and 100 inches of coal gas requiring 200 inches of oxygen for its complete combustion. If, however, 100 inches of coal gas be mixed with a thousand inches of air, this mixture will be explosive, since it will contain the relative proportions of the inflammable gas, and the supporter most favorable to inflammation or explosion. We know that when coal gas, or the fire-damp of mines, is mixed with air in proportions of one volume of the gas former to any number of volumes intermediate between 5 and 10 of the latter, the mixture is explosive, but it is only so to a certain extent. When the proportions of air exceed 12 or 12½ volumes of inflammable gas, the mixture is not explosive—an excess of oxygen having, in this respect, the same effect as its deficiency.

a similar stream across the upper portion or apex of the flame. We may obtain satisfactory proofs that these views are correct, if we consult any intelligent artificer who is in the habit of using the blow-pipe.

28. If we pass a piece of wire gauze across the base of a jet of coal gas (in the blue portion of the flame), the gas will continue to burn above the gauze as well as below it, and no free carbon will be deposited on the under side of the gauze; nor will there be any set at liberty from the flame above the gauze. By passing the gauze upwards, and holding it near to the apex of the flame, we shall perceive a different result. Free carbon will be deposited in abundance on the under side of the gauze, the flame above it will be extinguished, and, as the gauze becomes heated, a dense vapor of carbon will pass through, which may be inflamed.

29. This experiment may be varied, by substituting for a jet of coal gas the flame of a wax taper, a common candle, or an oil lamp. Instead of wire gauze, if we pass a piece of writing paper, or card board, into the blue portion of the flame, it will not be tarnished; we may repeat the same process about half way up the flame, and with the same result; but if we ascend towards the apex of the flame, the paper or the card will be blackened by the deposition of free carbon. Finally: if we hold the paper or card above the flame, it will not be blackened, a proof that no free carbon escapes into the atmosphere.*

30. An equal quantity of oxygen will combine with a given quantity of coal gas, or of carburetted hydrogen gas, under circumstances very dissimilar, and producing in one case a very feeble, and in the other a very brilliant light. Thus, two volumes of oxygen being mixed with one volume of coal gas, and the mixture inflamed as it issues from a jet, the flame will be small, of a pale blue color, and afford a very feeble light (19). One volume of coal gas, with ten volumes of air, will produce a similar effect, the flame being of a somewhat deeper color (19). When coal gas is inflamed in an atmosphere of oxygen gas, the flame is larger than ordinary, and the light from it exceedingly brilliant; and, as already mentioned, the same quantity of oxygen combines with a given quantity of the inflammable gas, as in the two former instances. The resulting compounds are alike in quantity and in character in each case (22).* The phenomena that accompany the combustion of coal gas, under ordinary circumstances, for the purpose of artificial illumination, are so well known that they can need no particular description.

31. If the flame of an explosive mixture of coal gas and oxygen, or atmospheric air, be treated with wire gauze or card board, as already described (28, 29,) it will be found that no free carbon will be liberated at any part of the flame, either within it or above it.

32. If there be projected upon a flame of coal gas a strong current of air, the flame will immediately be diminished in size, and it will exhibit all the properties of the flame of an explosive mixture (19, 31.)

33. In an attentive observation of the combustion of an explosive mixture of coal gas, or carburetted hydrogen and atmospheric air, within a safety lamp, we shall be sure to notice how speedily the flame from the wick will be extinguished. It will not, I suppose, be denied that this is occasioned by the absence of oxygen.

34. It may be ascertained by mere inspection, that the flame of the mixture within the lamp is hollow. Towards the top of the lamp the flame will sometimes assume a more brilliant aspect than at any other part. It more frequently happens, however, that free carbon (smoke) will escape from the top of the lamp.

35. If it be inquired whence arises the luminosity of the flame at the upper part of the lamp, or, in its absence, the free carbon (smoke), already mentioned, I reply, that whilst the explosive mixture burns within the cage, the heat evolved will be sufficient to carry on the evaporisation of the oil in the reservoir of the lamp. This vapor occupying, in a partial degree at least, the interior of the flame, will be converted into oil gas; and if there be present in the explosive mixture a large proportion of oxygen, a part of the gas will be decomposed, exhibiting its peculiar brilliancy (45). But should there be only a small proportion of oxygen present, the nascent oil gas will not become luminous, although it may be decomposed, and hence the separation of free carbon (smoke).

36. That the view here taken of the vaporisation of the oil is correct, may be satisfactorily proved, by employing in a similar mixture of explosive gases two safety lamps,

* The process of introducing and withdrawing the paper or card must, of course, occupy only a moment. The flame employed should be so trimmed as to be free from smoke.

* Such frequent reference is made to coal gas, because now that gas light is making rapid progress among the provincial towns of this kingdom, there will be greater facilities than formerly for obtaining it in researches of this kind. I object to the employment of the generic term, carburetted hydrogen, in a sense synonymous with coal gas.

one with the wick and the reservoir of oil adapted in the usual way, the other with a temporary wax wick attached to the reservoir, but without any oil therein. The relighting of the wick, on the re-admission of oxygen to the lamp containing oil, is, under these circumstances, perfectly intelligible (16, 17.)

37. An explosive mixture will burn tranquilly within a safety lamp, without raising the wire gauze to a temperature that will communicate inflammation to the surrounding atmosphere of explosive gases, so long as that atmosphere remains undisturbed; but if the lamp be exposed to a current of the explosive gases, the flame within the lamp will be driven against the wire gauze at the side opposite to that whence the current flows, and then the gas will become sufficiently heated to permit the flame to pass through, or to communicate inflammation to the external atmosphere.

38. Those explosive mixtures, the proportionals of whose elements assimilate the nearest to two volumes of hydrogen and one volume of oxygen, yield by combustion the greatest quantity of heat from a given volume of the mixture. Hence it is easy to understand that the relative proportions of a third element, as carbon in carburetted hydrogen, and azote in atmospheric air, determine the specific temperature of the mixtures in which they may be present.

39. The security afforded by the use of a cage of wire gauze in an explosive atmosphere is not entirely due to the radiating properties of the metal. The temperature, at any particular part of a large cylindrical film of flame of an explosive mixture, burning tranquilly within a safety lamp, will be very inferior to that arising from the combustion of the same materials under different circumstances. The vaporisation of the oil (35) will engage a portion of the heat given out by the combination of the gases. But there is another condition that demands especial notice. Whilst a current of the explosive mixture is flowing *inwards* through the interstices of the gauze at the base of the cage—which current, from its temperature and direction, cannot possibly communicate inflammation to the external atmosphere—a similar current of non-explosive materials (aqueous vapor, carbonic acid gas, free carbon, and azotic gas,) must be necessarily flowing *outwards* near the top of the lamp.* When these tranquil currents are disturbed by a sudden rush of the explosive atmosphere, or of comparatively fresh air, then it is that explosion ensues.

40. The phenomena that accompany the tranquil combination of explosive mixtures, at a temperature below that which is sufficient to inflame them, are so numerous and so interesting, especially when viewed in connection with Mr. Faraday's late researches into the action of platina upon gaseous bodies, that they will require a separate notice.

41. Having thus enumerated with a minuteness that it is feared will be considered by some as unnecessary, a variety of phenomena connected with flame, it now remains that we should inquire if the facts eliminated support and illustrate the theory of flame, as announced by Sir H. Davy, and the views which are advanced by other writers, some of whom stand deservedly high in the scientific world.

42. It is stated by Davy, in his Treatise on the Safety Lamp, 8vo., London, 1825, p. 46: That "the flame of combustible bodies, in all cases, must be considered as the combustion of an *explosive mixture* of inflammable gas, or vapor and air: for it cannot be regarded as a mere combustion at the surface of contact of the inflammable matter; and the fact is proved by holding a taper or a piece of burning phosphorus within a large flame made by the combustion of alcohol, the flame of the candle, or of the phosphorus, will appear in the centre of the other flame, proving that there is oxygen even in its interior part."

Dr. Ure, Dict. Chem., 4th edit., London, 1831, has quoted verbatim the above paragraph, Art. Combustion, p. 357, without acknowledgment. He has also enriched his pages by copious extracts from Davy's work throughout the same article.

Dr. Graham, Chem. Catechism, 2d edit., London, 1829, Art. Combustion, p. 589, also quotes without acknowledgment a part of the paragraph. In a note there is the following piece of information: "The form of flame is conical, because the greatest heat is in the centre of the *inflammable mixture.*"

Dr. Thompson says, in his admirable Treatise on Heat and Electricity, 8vo., London. 1830, p. 309: "Flame is the rapid combustion of volatilized matter. The tallow or the wax is melted and drawn up to the top of the wick of a candle. Here it is boiled and converted into vapor, which ascends in the form of a column. This vapor is raised to such a temperature that it combines rapidly with the oxygen of the surrounding atmosphere, and the heat evolved

* The comparatively low temperature of the flame of explosive mixtures present in coal mines, is doubtless owing, in a great measure, to the vast quantities of azotic gas contained in those mixtures.

is such as to heat the vapor to whiteness. Flame, then, is merely volatile combustible matter heated white hot. The combustion can only take place in that part of the column of hot vapor that is in contact with the atmosphere, namely, the exterior surface. The flame of the candle, then, is merely a thin film of white hot vapor, enclosing within it a quantity of hot vapor, which, for want of oxygen, is incapable of burning."

Dr. Lardner, Cab. Cyc., Treatise on Heat, p. 358, seems to entertain similar views to those expressed by Dr. Thompson. By the frequent interchange of the terms "gas," and "vapor," the passage in the Cab. Cyc. is, however, rendered somewhat obscure.

43. If we observe with attention the flame of a combustible body with whose habits we are familiar, say, for example, a common tallow candle, it will be found to exhibit the following phenomena. The tallow being liquified by the proximity of a burning body, rises, by capillary attraction, between the filaments of the wick. As it approaches the flame it is converted into vapor, from which state it readily passes into that of gas. The flame not being in actual contact with the wick (1), the vaporisation of the tallow goes on simultaneously at every part of the wick surrounded by the flame. The blue portion of the flame, at its base, as well as the fainter film of blue that surrounds its other parts, denote the chemical union of carburetted hydrogen and oxygen gases (19, 30, 31.) As this union is a continuous process, accompanied by the evolution of heat, a temperature is speedily attained of sufficient intensity to decompose a great proportion of the nascent inflammable gas. By this decomposition successive portions of carbon are separated from hydrogen. The hydrogen combines with oxygen, forming water; the carbon at this elevated temperature becomes luminous, and combining also with oxygen, yields carbonic acid gas (22).

44. It will be seen that I do not agree with Dr. Thompson (42), who maintains that the flame of a candle "is merely a thin film of white hot *vapor*." We are accustomed to say, that the vapor of certain bodies, as of alcohol, or ether, is inflammable, but I consider the inflammability of these vapors is due entirely to the facility with which they are convertible into gases under certain specific conditions, and the influence of a certain temperature.*

45. If the view we have taken be correct (43), it seems that the combustion of a tallow candle involves a somewhat complicated, yet, if carefully analyzed, an exceedingly beautiful process. It is a conical film of luminous matter (1), changing gradually upwards, from blue to white. It contains, in its interior, nascent inflammable gas; but no oxygen (15, 16.) At the very base of this film of flame, at a temperature which may be termed specifically its own, we may perceive indications that a chemical union is going on between carburetted hydrogen and oxygen gases; aqueous vapor and carbonic acid gas being projected from the flame at this part.* The supply of inflammable gas from within being constant and regular, and an equally uninterrupted supply of oxygen being established by the rarefaction of that portion of air in the immediate vicinity of the flame, the heat given out by the sudden union of one portion of inflammable gas with oxygen is sufficient to decompose a large portion of the same material. To the latter part of the process are we indebted for the illuminating properties of the flame. Hence also, those important distinctions perceptible in different parts of the same flame (30).

46. The flame of combustible bodies cannot, therefore, "in all cases be regarded as the combustion of an *explosive mixture* of inflammable gas, or vapor and air," but as the tranquil and progressive combination of inflammable gas with oxygen. The combustion of explosive mixtures differs from that of a common candle or coal gas, (19, 20, 30, 31, 43, 44, 45,) inasmuch, that in one case there is an immediate combination of all the inflammable gas with oxygen; in the other, a part only so combines, whilst the greater portion undergoes decomposition previous to its ultimate combination (29). The resultants are the same in both cases; but the conditions that produce them essentially differ.

47. What has been said respecting the flame of a candle may be applied, without

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* Some have maintained that the bodies we designate gaseous are nothing more than vapors. I here only speak of things as we find them. If gases are vapors, we know them to be more complex and refined, as regards the arrangement of their particles, than vapors, in the popular acceptation of the term. Should it be objected that vapor of certain inflammable bodies detonate, if mixed with oxygen, in the same way as explosive mixtures of gases, I have only to reply that the detonation is the result of the sudden and spontaneous evolution of gas, and its re-union with the oxygen present. These processes may be the work only of 1-100th or 5-100th part of a second.

* To ascertain this fact by experiment, the following simple means may be employed: If a piece of cold glass or polished metal be held near the blue part of the flame, aqueous vapor will be projected upon it. 2. If a drop of a saturated solution of lime (lime-water) be held at the end of a small glass rod or tube near the blue flame, the water will become turbid—carbonic acid gas combining with the lime and separating it from the water. This latter experiment must be the work of a moment, or we may be deceived by simply vaporising the water.

difficulty, to the flame of those combustible bodies with which we are familiar in the ordinary affairs of life. The flame of a tallow candle, an oil lamp, and a coal fire, present not only similar, but identical phenomena. The flame of coal gas differs from each of the preceding. In the three former there is a vaporisation of the elements of the combustible body,—a spontaneous, or, if I may employ the term, an extemporaneous transition of this vapor to gas; then follows inflammation, decomposition, and re-composition. In the latter case, the gas being previously generated, inflammation is the first stage in the process of combustion: the subsequent stages are identical."*

48. That all the vapor arising from a combustible body is not, excepting under particular circumstances, converted into gas, is abundantly evident by the free carbon (smoke) that arises from a candle, a lamp, and a coal fire. Equally evident is it that certain conditions must be observed in effecting the combination of all the elements of a previously prepared gaseous body with oxygen. This we learn by the free carbon (smoke) given off from coal gas, when too much is admitted to the burner.

49. Those bodies which contain a large portion of carbon, as compared with their other elements, require different management from those whose elements of inflammability assimilate in more exact proportions. It will be sufficient to mention, and to place in juxta-position,

Ether - -	Spirit of turpentine.
Sperm oil - -	Coal tar.

In ether and in sperm oil, hydrogen and carbon exist in such proportions, that they readily pass through the several stages already described (47), and form with oxygen new compounds.† Spirit of turpentine and coal tar, containing, on the contrary, an excess of carbon, require a different treatment to effect their entire combination with oxygen.

50. It is inexplicable why Davy employed a larger flame of alcohol in his researches in preference to a smaller one, since it is so difficult to conduct with the former a fair and accurate experiment, whilst with the latter the results are uniform and conclusive (8, 12); we have no difficulty in ascertaining that flame is hollow (1, 2, 3, 4, 5, 6, 7;) we have the most conclusive evidence that oxygen exists not in the interior of flame (8, 9, 10, 12, 13, 14, 15, 16, 17); not even in that of explosive mixtures (33). And equally certain is it that the habits of explosive mixtures are very unlike those exhibited by combustible bodies under ordinary circumstances (19, 20, 21, 23, 30, 31.) Further, we may not only satisfy ourselves that the flame of a candle or lamp is conical and hollow, but we may ascertain that it does not consist only of a thin film of luminous matter, and that combustion takes place only at the surface where the inflammable gas comes in contact with oxygen. Thus, the flame from an Argand burner, when air has access to its interior, is not only cylindrical, but hollow, *i. e.* it consists of two concentric cylinders, or films of luminous matter (3, 4,) whilst the flame from the same burner, when air is excluded from its interior, consists only of one cylinder, or an external film (5). Difficult as it may be to understand how so eminent a philosopher as Davy could have erred in relation to this subject, I think we have no alternative but to reject his theory of flame, since it is wholly unsupported by fact and experiment. This will be done, I have no doubt, by all who, unbiassed by prejudice, and unawed by great names, will take the trouble to investigate the matter for themselves.

J. N. O. Rutter.

Lymington, Hants, May 14, 1834.

The Steam-Engine, the Cotton-Spinner's Best Friend. [From Mr. Tuffnell's Report to the Central Board of Factory Commissioners in England.]

Of all the common prejudices that exist with respect to factory labor, there is none more unfounded than that which ascribes to it excessive tedium and irksomeness above other occupations, owing to its being carried on in conjunction with the "unceasing motion of the steam-engine." In an establishment for spinning or weaving cotton, all the hard work is performed by the steam-engine, which leaves for the attendant no manual labor at all, and literally nothing to do in general, but at intervals to perform some delicate operation, such as joining the

* The quality of the light from different bodies will depend—all other circumstances being the same—on the qualities of the combustible body. The most intensely white light evidently contains a greater portion of olefiant gas than a dull yellow light. It is not, however, unworthy of remark, that very much depends on the management of the materials. A tallow candle, with a small compact wick, will yield a more brilliant light—I mean as to its quality—than a similar candle with a large fibrous wick. What is usually termed the perfect combustion of the materials is, in fact, only another term for the perfect combination of all the inflammable elements with oxygen.

† It may not be improper to remark, that when aqueous vapor exists in an inflammable body, as in alcohol and ether, there must of necessity be oxygen present. When, however, the vapor of this body is converted into gas (44), the oxygen does not act the part of a supporter; but by combining with half its volume of oxygen, yields carbonic oxide, which, under favorable circumstances, becomes, by the addition of another half volume of oxygen, carbonic acid.

threads that break, taking the cops off the spindles, &c. And it is so far from being true that the work in a factory is incessant, because the motion of a steam-engine is incessant, that the fact is, that the labor is not incessant on that very account, because it is performed in conjunction with the steam-engine. Of all manufacturing employments, those are by far the most irksome and incessant in which steam-engines are not employed; and the way to prevent an employment being incessant, is to introduce a steam-engine into it. And these remarks, strange as it may appear, apply peculiarly to the labor of children in cotton factories. Three-fourths of the children so employed are engaged in piecing at the mules, which, when they have receded a foot and a half or two feet from the frame, leave nothing to be done,—not even attention is required either from spinner or piecer, but both stand idle for a time, which, if the spinning is fine, lasts in general three-fourths of a minute or more. Consequently, in these establishments, if a child remains during twelve hours a day, for nine hours he performs no actual labor.* A spinner told me that during these intervals he had read through several books. The scavengers, who have been said to be "constantly in a state of grief, always in terror, and every moment they have to spare, stretched all their length upon the floor in a state of perspiration,"† I have seen idle for four minutes at a time, and certainly could not find that they ever displayed any symptoms of the condition described in this extract from the Report of the Factory Committee.

If we wish to discover occupations which are really laborious, irksome, and incessant, we must go to those trades in which, not only no steam-engine, but no machinery whatever, is used. The employment of millíners' girls is one of this description; they are engaged in it for a far longer period of time than the factory children; and I have it in evidence from medical gentlemen (page 120, First Report,) that their health is more seriously affected by it than that of persons in factories. Surely bending over a needle sixteen hours a day cannot be deemed otherwise than laborious, irksome, and incessant in the highest degree. But the case of the pin-headers is the most glaring instance of the absurdity of the principle that sets a brand on those trades alone in which steam-engines are employed. The unhappy children engaged in this business, who are of a far tenderer age than any in factories (as I have seen them working at it before they have reached their sixth year), have to sit twelve hours daily at a table, with their bodies continually bent in the form of the letter C, their eyes intently fixed upon the pin-heads, and both hands and feet in perpetual motion.

At Derby there is a magnificent establishment for making bobbin-net, in which the whole of the machinery is moved by a steam-engine. The same machines are used at Nottingham, with the difference that they are there mostly worked by hand, and consequently the labor is infinitely heavier. In the Derby factory the labor required is so slight and discontinuous, and the machine performs its work with such admirable precision, that many of the workmen were literally asleep in their places when I visited the establishment; yet they are included in the Ten Hour Bill, while their Nottingham brethren are omitted. The master of the establishment complained of the serious loss he should sustain by the operation of the bill, and asked me what justice there was in subjecting his business to it, in which the labor of the workmen was evidently so light, while the hard-worked operatives in the factories of his Nottingham rivals were left untouched? I could not answer his question.

The most irksome employment connected with cotton-spinning is "picking" cotton for fine work, an operation which is generally performed by the youngest children in the following way: A fleece of cotton is hung up before the window, and the child standing constantly in the same place, with its head about six inches from the fleece, picks out the particles of dust that are lodged in it. The wearisomeness of this occupation must be, beyond all comparison, greater than that of the piecers or scavengers, as the child cannot stir from its place, but must keep perpetually looking at a bit of cotton; but it is not assisted by the steam-engine, consequently it may be worked twenty-four hours, or any number of hours, without intermission, for any thing Lord Ashley's Bill says to the contrary. In the coarse factories this work is done by the steam-engine, and therefore the child who attends the operation has not a tenth part of the labor to perform which it otherwise would have. Here, then, it is protected by a factory bill.

Occupations which are assisted by steam-engines require for the most part a higher species of labor than those which are not;

* A piecer, however, generally attends two mules, whose motion is alternate, and then his leisure is six hours instead of nine.

† See Report of Factory Committee, page 325.

the labor of the head is then partially substituted for the labor of the muscles; in fact, it becomes in some measure skilled labor, and, like all skilled labor, is paid highly, as the tables of wages I have given prove. In no other way can I account for the comparative high wages which factory workmen, whether children or adults, obtain. "Batting" cotton seems by far the most laborious employment in a factory; it is performed entirely by women, without any assistance from the steam-engine, and is at least as hard as threshing corn, to which it has a great similarity; yet those engaged at it do not earn, on an average, more than 6*s.* 6*d.* weekly, while, close by, may be seen women, and even children of fourteen, earning double and treble that sum at stretching or power-loom weaving, in neither of which occupations is the labor one quarter as great. In power-loom weaving especially, the manual labor seems to be really nothing, as those who work at it frequently follow the motion of the lay by leaning on it with their arms, with the view of taking exercise; it is also the healthiest of mill occupations.—Were factory work in every department seriously detrimental to health, this circumstance would account for the high rate at which it is paid; but the evidence proves so strongly that such is not the case, that we are compelled to resort to some other explanation.

Shall I be better believed, when I state that I myself a short time ago was impressed with the common prejudice respecting steam-engines, viz. that employment at them tended to degrade a man into a machine, and deaden all the powers of his mind? The minute attention I have been compelled to pay to this subject in discharging the duties of this commission has convinced me that this is an idle and groundless notion, and in fact, in most instances, it is the reverse of truth. Whatever employments have this degrading tendency are among those in carrying on which no mechanical ingenuity has been applied: a workman of a superior class is always required to attend delicate or complicated machinery. Of course a child nine years old cannot be expected to display much skill in its work; but its education in factory labor must begin at that age, or it never can become a good skilled workman. Those who enter a mill at sixteen or seventeen always labor under great disadvantage, and earn comparatively little wages, from their inability to acquire that degree of tact and skill necessary to the due performance of factory work.

But the misrepresentations that have been put forth on the subject of the fine-spinning mills are perhaps the most extraordinary of all. I have no hesitation in saying that the labor in the fine-spinning mills of Manchester is lighter, pleasanter, and not less healthy, than in any other mills in the town. The lightness of the labor is owing to the slowness with which the machinery moves in spinning fine numbers. The mule in spinning No. 30 or 40 makes in general three stretches a minute; in the high numbers only one, and sometimes less. This fact I have ascertained with the utmost precision, by frequently timing the motion of the machine, holding a watch that marked the moments in my hand. During at least three-fourths of this minute, the piecers, five of whom usually attend two mules, each containing 360 spindles, have literally nothing to do; they then stand listlessly by, their attention engaged by any thing but their work, till the mule recedes, when they instantly proceed to piece the threads which break, or are purposely broken (as in fine spinning, if a knot is perceived in any part of the yarn, it is intentionally broken.) The piecing cannot take up long, as the mule has no sooner arrived at the frame than it instantly begins to advance, and when it has got about a foot and a half or two feet from the frame, it is impossible to reach over to the rollers, and the period of idleness begins. There is far less work for the scavengers to do in fine-spinning than in coarse, on account of the waste being so much smaller, and consequently this part of the business is usually done by one of the piecers. Another superiority which these establishments have over the coarse-spinning factories consists in the small quantity of dust that is evolved in every stage of the process; in fact, in the spinning-rooms there may be said to be no dust at all.

I was particularly struck with the portly appearance of many of the spinners in these establishments; and one of the fattest men I saw in Manchester was spinning No. 180 in Mr. Houldsworth's factory, and he had been engaged in this work seventeen years. Another whom I questioned had been a fine-spinner for thirty-six years, and he was employed in spinning No. 200 at the moment I spoke to him. One of the most violent witnesses for the Ten Hour Bill that I examined (Thomas Wilson, page 65, Second Report,) says that his health was much better when he worked in a fine-spinning mill than in a coarse. In short, the fine-spinning mills, which have been made the object of such deadly hostility, are, scientifically speaking, the glory of Manchester.

Nothing can exceed the beauty, delicacy, and ingenuity of the machinery, the order in which it is kept, or the extraordinary results it is capable of producing. I have seen cotton spun in them of the number 350; in other words, a pound of cotton is stretched to the incredible length of 294,000 yards, or 167 miles, and is then sold for twenty-five guineas, the original cost of it having been 3*s.* 8*d.* It is the only part too of the cotton trade in which England is absolutely unrivalled, as, with the exception of some attempts that have been made in France, no other nation can approach us in this department of manufacturing. The export of fine yarn is increasing more rapidly than of any other description of cotton goods. It is impossible to keep the coarse-spinning mills in the same order as the fine, owing to the greater dust occasioned by the work, and the machinery not being required of equal delicacy. They have, however, other peculiarities, which make them at least as worthy of attention. For instance, there is not unfrequently attached to them a department for power-looms, which are among the most extraordinary machines in a factory. I have stood by one of these looms, and minuted its operations with a watch, when I have seen it weave seventy-two square inches of cloth in a minute, without any human being attending to it. In factories thus furnished, the cotton enters in a raw state, and comes out as cloth; and of the numerous machines through which it has to pass, including the steam-engine which moves them all, there is not one that does not seem to demand the utmost stretch of human ingenuity to bring it to its present state,—not one that does not condense in its formation the result of at least a hundred patents, or that has not required in its invention the united efforts of at least a hundred minds.

SAILING AGAINST THE WIND.—A correspondent of the United Service Journal offers the following suggestion: Let a ship be provided with sails, &c. like those of a windmill, which will be turned by the wind, and let the power thus acquired work a paddle-wheel: thus a power would be obtained from an adverse wind equivalent to that of steam. This apparatus should be employed on each side of the ship; it would not be extensive, it would be moveable, it may be taken to pieces and put together when wanted; and if successful, promises to be a most useful invention, as we should no longer hear of ships being detained for weeks in port, or delayed almost indefinitely on their voyage by adverse winds.—[London paper.]

The following letter of GENERAL WASHINGTON, addressed to a mercantile establishment in London, has been politely lent us to copy. The possessor of the original has had numerous offers for the MS. in London and in this country, which he has uniformly refused. He is now wishing to dispose of it; should any of our friends wish to possess such a relic, a line addressed to W. T., care of the Editor of the Mechanics' Magazine, New-York, will meet with every attention.

MOUNT VERNON, 10th August, 1760.

GENTLEMEN,—By my friend, Mr. Fairfax, I take the opportunity of acknowledging the receipts of your several favors that have come to hand since mine of the 30th Nov. last, and observe in one of them of the 14th Feb., by Crawford, that you refer to another by the same ship, but this has never appeared.

Inclosed you are presented with the mem. for receiving the interest of the Bank Stock signed as directed. The State not yet being so amply settled as it ought, an entire division has not been made, which leaves many matters upon an instable footing, and among the rest, the money in your hands, which has not yet been assigned to individuals, although I believe it will chiefly, if not all, fall into my part, since it best suits my purposes to have money that can be commanded than money at interest. However, till matters come to a more conclusive settlement you may let the accounts stand as you have stated them, charging each party with their own Drafts and Orders, and letting the Credits remain in favor of the Estate as a common Stock till further directions. The Tobacco ship'd per the Fair American, Cary, & Russia Merchant, may be applied the same way; but the present [growing] Crop will be ship'd on my own, and Jno. Parke Custis's particular accounts [each having our plantations allotted us,] and must be applied to our several credits as you will be directed —so must all the remittances hereafter to be made.

The Insurance on the Tobacco, per Talmon, was high, I think—higher than I expected; and here, gentlemen, I cannot forbear ushering in a complaint of the exorbitant prices of my Goods this Year, all of which are come to hand [except those packages put on board Hooper.] For many years I have Imported Goods from London, as well as other ports of Britain, and can truly say, I never had such a pennyworth before. It would be a needless task to innumerate

every article that I have cause to except against: let it suffice to say, that woollens, linens, nails, &c. are mean in quality, but not in price; for in this they excell, indeed, far above any I have ever had before. It has always been a custom with me when I make out my invoices, to estimate the charge of them; this I do for my own satisfaction, to know whether I am too fast or not, and I seldom vary much from the real prices, doing it from old notes, &c.; but the amount of your Invoice exceeds my calculations above 25 per cent., and many articles not sent that were wrote for.

I must once again beg the favor of you, never to send me any goods but in a Potomac Ship; and for this purpose let me recommend Capt. John Johnson, in an annual ship of Mr. Russels to this river. Johnson is a person I am acquainted with—know him to be very careful, and he comes past my door in his ship; I am certain, therefore, of always having my goods landed in good time and order, which never yet has happened when they come into another river. This year the Charming Polly went into Rappahannock, and my goods by her received at different times and in bad order—the Porter entirely drank out. There came no Invoice of Mrs. Dandridge's Goods to me; some suppose it was forgot to be Inclosd.

I was owing Mr. Knox, of Bristol, a balance of £51 5s. 11d., to discharge which, and be out of that Gentleman's debt, I shipd Mr. Farrel eight Hhds. Tobacco in April last, desiring him out of the proceeds to pay the above sum; but if in case [which I thought hardly possible] this Tobacco should be insufficient to answer this purpose, then for him to draw upon you for what it might fall short; you will please, therefore, to notice this; and Mrs. Fairfax having kindly undertaken to purchase something for Mrs. Washington, to the amount, I suppose of Fifty or Sixty pounds, I must likewise desire the favor of you to pay my order in his favor as soon as presented. When you have received the money for the inclosed bill, please to credit my account for it.

As I shall write to you again by the Fleet, I shall decline giving any directions about the Busts till then. Sometime ago there was a prospect of making a large crop of Tobacco this summer, but a series of wet weather for near a month with little or no Intermission has caused general complaints among the Planters, and now it is feared that the crops will be very short. The Tobacco in many places being under water and Drownd, and in others suffering much by the Spot, which is always a consequence of such rains.

My Steward on York river writes me that he has received the Goods ordered from Glasgow. Inclosed I address you the copy of a letter wrote from Williamsburg in April last, and in a letter of the 20th of June I advertised you of two drafts I had made upon you, the one in favor of Mr. Jno. Addison, for £364 19s. 0d., and the other of Mr. Will'm. Digges, for £304 15s. 8. These payments were in part for a valuable purchase I had just made of about 2000 acres of land adjoining this Seat—there are more payments yet to make, and possible I may have occasion to draw upon you for a further sum, though not more, I am well persuaded, than you have effects to answer. Yet if at any time a prospect of advantage should lead me beyond this a little, I hope there will be no danger of my bills returning. I mention this rather for a matter of information [In case such an Event] than as a thing I ever expect to happen, for my own aversion to running in Debt will always secure me against a Step of this nature, unless a manifest advantage is likely to be the result of it.

Since writing the foregoing I have added to my landed purchase, and shall have occasion in a few days to draw upon you to the amount of about £250 payable to Mr. Rob. Brent—save a bill of about £40 which will be passed in favor of Mr. Clifton.

I am, Gentlemen, Your Most Obedient,
Honorable Servant,
GO. WASHINGTON.

METEOROLOGICAL STONE.—A Finland journal gives an account of a singular stone in the north of Finland, where it answers the purpose of a public barometer. On the approach of rain, this stone assumes a black or dark grey color, and when the weather is inclined to be fair, it is covered all over with white specks. This stone is, in all probability, an argillous rock, containing a portion of rock-salt, ammonia, or salt-petre, and absorbing more or less humidity in proportion as the atmosphere is more or less charged with it. In the latter case, the saline particles, becoming crystallized, are visible to the eye as white specks.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, E. E. Minor and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum *in advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

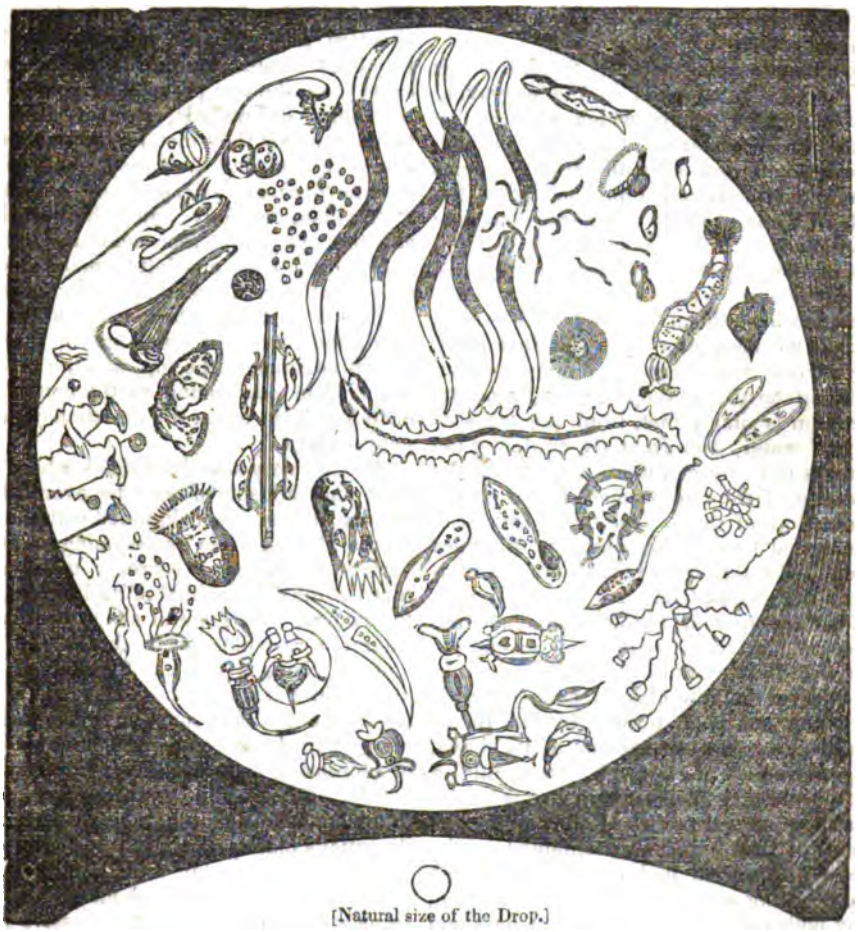
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] AUGUST, 1834. [NUMBER 2.

If one train of thinking be more desirable than another, it is that which regards the phenomena of nature with a constant reference to a supreme intelligent author. * * * * * The wor'd from henceforth becomes a temple and life itself one continued scene of adoration.—BISHOP PALEY.

WONDERS OF SCIENCE.



[Natural size of the Drop.]

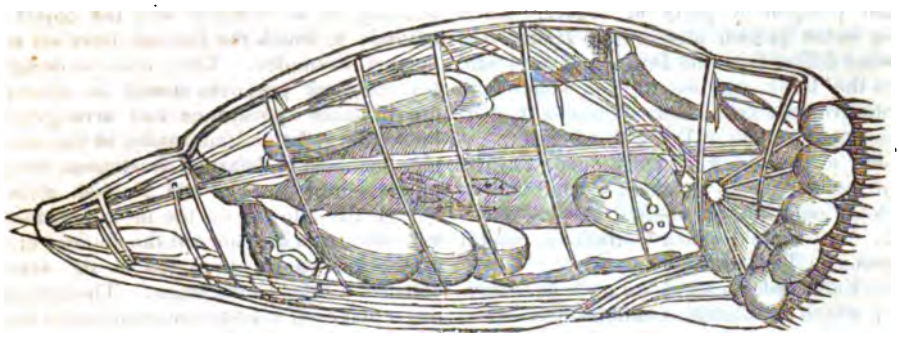
MICROSCOPIC VIEW OF A DROP OF WATER.—It is not certainly known when or by whom the microscope was invented. On the one hand, we are told that one Drebell, a Dutchman, had the first microscope in the year 1621, and that he was reported to have been the inventor of the instrument. On the other hand, the invention is claimed by Francis Fontana a Neapolitan, in 1646, who dates it from the year 1618. Thus far, however, appears to have been distinctly ascertained, that they were first used in Germany about the year 1621. The telescope is generally believed to have been invented in the year 1590; and, as a microscope is only a telescope inverted, the invention of the one may be readily believed to have originated in the use of the other.

It may, perhaps, be matter of doubt which of those instruments has introduced the most wonderful facts to our notice. If the telescope has brought us acquainted with vast bodies which we had not previously conceived to exist, and thus unmeasurably extended our conceptions of the vastness of the universe, and the power of its Creator, it is no less true that the microscope, though, perhaps, with less imposing pretensions, has laid open to us most unexpected revelations of the wisdom, the power, and the providence of the Almighty, by discovering to us innumerable orders of living beings, endowed with numerous capacities, and provided with ample means of enjoyment.

An example which partially illustrates this last remark is supplied in the engraving prefixed to this article, which represents a single drop of water as it appears through a microscope, peopled with various species of minute animals called *animalcules*, of the habits of some of which we purpose to give a brief account. It may be observed in general of the microscopic orders of animals, that the smallest which have ever come under notice have been discovered in water. Not that we may infer from this that there are not creatures of equally diminutive size inhabiting the air, or creeping upon the earth; the reason is simply that, from the transparency of water, and from its confining the creatures in it, we can more easily bring the assistance of the microscope to bear on the examination of them. Of these, indeed of all animated beings, the *monas* is the most simple. The termo is the most minute creature of this genus, being so extremely delicate and transparent as often to elude the highest magnifying powers, and seeming to blend with the water in which it swims. Another and very minute class of animalcules is that which has been termed by Mr. Baker the hair-like insect, on account of its shape, being extremely slender, and frequently a hundred and fifty times as long as it is broad. These creatures are so small, that millions of millions of them might be contained in the space of a square inch. Yet low in the scale of being as they may appear to stand, owing both to their extreme minuteness and the simplicity of their structure, even these, in common with those orders of inferior animals with which we are more ordinarily conversant, exhibit indications of sagacity, and of the formation of habits. They seem, for example, to be fond of society; for, after viewing for some time a quantity of them taken up at random, the observer will see them disposing themselves in a kind of regular order. If a multitude of them are put into a jar of water, they will form themselves into a regular body, and ascend slowly to the top. When they are weary of this situation, they form themselves into a kind of rope, which slowly descends as low as they intend; but if they happen to be near the side of the jar they will descend upon it. In one experiment, a small quantity of matter containing these animalcules having been put into a jar of water, it so happened that one part went down immediately to the bottom while the other continued floating at the top. When things had remained for some time in this condition, each of these swarms of animalcules began to grow weary of its situation, and appeared disposed to change it. Both armies, therefore, set out at the same time, the one proceeding upwards and the other downwards, so that after some hours' journey they met in the middle. A desire of knowing how they would behave on this occasion engaged the observer to watch them carefully, and to his surprize he saw the army that was marching upwards open to the right and left to make room for those that were descending. Thus, without confusion or intermixture, each held on its way; the army that was going up marching in two columns to the top, and the other descending in one column to the bottom, as if each had been under the direction of intelligent leaders.

Another very singular animal, whose existence and habits have been discovered by the microscope, has been dignified with the name of the *Proteus*, from its assuming so great a variety of shapes as scarcely to be recognized as the same animal in its different transformations. Its general shape bears a considerable resemblance to that of the swan, and its changes are chiefly effected by its neck, which it sometimes extends to a considerable length, and sometimes disposes of it altogether. It also appears to have the power of increasing its transparency or opaqueness at will. There are no eyes, nor any opening in the head like a mouth, to be discerned; but its actions clearly prove that it possesses the faculty of vision, for though multitudes of other animalcules swim about with it in the same water, and its own progressive motion is very swift, yet it never strikes against any of them, but directs its course between them with astonishing dexterity.

Another and a very perfect animal is discovered by the microscope in rain water, which has stood for some days in leaden gutters, or hollows on the tops of houses. This is called the vorticella, or wheel animal. The following is a representation of it, magnified by the microscope one hundred



and forty-four thousand four hundred times. Its most remarkable distinction is the apparatus from which it derives its name, and which, from all descriptions, would appear strongly to resemble the paddles of a steamboat. They change their shape considerably in different views, but it seems pretty evident that they are circular wheels, which perform entire revolutions, and are provided with cogs similar to those on the balance-wheel of a watch. All the actions of this creature, says an observer, indicate sagacity and quickness of sensation. At the least touch or motion in the water, they instantly draw in their wheels; and it is conjectured, that the eyes of this creature are placed somewhere about this apparatus, as, while in the maggot state, its motions are slow and blundering, but after the wheels are protruded, they are performed with great regularity, swiftness, and steadiness. It is by these rotatory organs, also, that they are supposed to breathe.

Some very important discoveries have lately been made by Ehrenberg in his observations on these singular beings. By feeding infusoria with very pure colored substances, as indigo and carmine, he has ascertained the existence of mouths, stomachs, and intestines, and many interesting particulars relating to their structure and functions. But perhaps the most astonishing view of these animals, and of the wonders of the microscopic world in general, is presented by a recent improvement in the solar microscope—we refer to Mr. Gould's instrument, constructed under the direction of Mr. Cooper, and Mr. Carey, the optician,—the extraordinary effect of which is daily exhibited at No. 287 Strand. It acts on the general principle of the solar microscope, but is supplied with an artificial and most brilliant light, produced by the mixture of hydrogen and oxygen gases on lime. The writer had recently an opportunity of witnessing the effect of this extraordinary instrument, and, without describing in detail the beauties of the horrors which it brought to light from the invisible world, (in doing which he would be obliged to draw very largely on the faith of his readers,) he may give some general idea of the spectacle, by stating that the instrument magnifies *three hundred thousand times*, so that a drop of water appears to cover a surface of *a hundred square feet!*

We cannot but anticipate some important accessions to physical science from this extraordinary instrument, and we confidently recommend it to the notice of our readers as a source of much instruction and amusement.—[The Tourist.]

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 24.]

Q. What is implied by *Order* in Architecture?

A. It strictly defines system, method, regularity. Therefore, the first arrangement of the architect is to form every part of the fabric of proportionate extent, adapted to the magnitude of the whole.

Q. Whence the laws of order?

A. HE who created the universe out of chaos, and pronounced his workmanship *good*, has established it in all its grandeur. View the heavens and their revolving orbs; view nature in her receding forms; and we see the design of the Great Architect. That hand which wrought glory out of darkness and confusion moves all in a system so congenial to his will, and so beauteous to behold, as to implant in the mind of man, that, whilst such mighty objects are maintained in equal balance, and at equal distance, all sublunary objects must coincide with the universal regulations.

Q. How was this subject manifested by the ancients?

A. The Grecians and Romans to order

added component parts of orders. Each order bears its own character. Hence the Tuscan differs from the Doric, and the Doric from the Ionic, and so on; nor would each distinctive part assimilate. Thus a Corinthian capital upon a Doric shaft would resemble a grotesque figure indeed: in the same manner would appear a Corinthian entablature on a Tuscan shaft.

Q. Why should not a Corinthian capital surmount a Tuscan shaft?

A. Each order claims its own peculiarities; which peculiarities establish the order, and ascribe the honors to the several inventors. An unison of both would destroy originality and proportion, and render offensive to the eye that which custom, founded on the bases of correct principles, has passed from one age to another.

Q. What is meant by *Disposition* in architecture?

A. In the architectural phrase it signifies a just arrangement and an agreeable unison of all the parts of an edifice. Hence its signification becomes synonymous with order—but to be understood in a wider sense.

Q. What is the first thing to be attended to in the construction or modifying of an edifice?

A. The *Ichnography*, or ground plan: without a priority of consideration on this point, and a perfect acquaintance with the site of ground, no correct plan can be formed; for, whatever conveniences may be considered—whatever arrangements of departments may be made for an edifice by imaginary speculation,—the chance is most improbable, if ever that plan would be appropriated to the localities of the spot selected.

Q. How is this further illustrated?

A. The *Ichnography*, or *Ichnographic projection*, is a representation of the ground plot, described by right lines parallel amongst themselves, and perpendicular to the horizon, from every angle of every object, on a plane parallel to the horizon; the parts where the perpendicular lines or rays cut that plane being joined by right lines. The figure projected on the horizoutal plane is likewise called the *plan*, or seat of that object on the ground plan. The points are the sites, or seats of the angles of the object. The lines are the seats of the sides: by this it is to be understood how the bases of figure, represented as superstructures, stand, or are supported, and by which means the several parts and their areas can be accurately measured.

Q. What is the next consideration of the architect?

A. The *Orthography* or *Elevation* of the building, in accordance with the object intended; in which the Greeks have set such correct examples. Thus, edifices designed for religious purposes should be appropriate in their appearance and arrangement, both externally and internally, to the principles inculcated, bearing chasteness, simplicity, solemnity. The old English style is universally allowed as the most becoming; with this style also accord the edifices erected for learning, exemplified in the several colleges of the Universities. Theatres and other places of amusement, and public buildings, may be built in consistence with the livelier orders of the Ionic, Corinthian, and Composite.

Q. Define Orthography in its architectural acceptation?

A. Orthography represents the vertical position and appearance of the edifice; whence the orthographic projection is called *elevation*. When the *front* of a house is represented it bears this term, and when the side is shown, it is denominated the *profile*, or *flank elevation*. Supposing a house, or any other object, to be divided by a plane passing perpendicularly through it, in a line at right angles with the point, it is called the *lateral section*; but if the plane pass in a direction parallel with the front, it is termed a *longitudinal section*. If the plane pass in either of the former characters, (not, however, deviating from the vertical,) it is said to be an *oblique section*.

Q. What of the situation of buildings?

A. That is entirely circumstantial; choice, advantage, and other causes, govern individuals in their selection. A man of taste will undoubtedly choose a spot, the prospect from which is most agreeably diversified in the distribution of its lands, its woods, and its water; and those who have no relish to the charms of nature, will, perhaps, consult their own comfort more than they may be aware of, by making the same choice.

Q. What is the best disposition of the several departments?

A. Much depends on the relative situation of the house, prospect, &c. Libraries, studies, breakfast-rooms, particularly bedchambers, should face the east. Dining-rooms should face the south, and drawing-rooms the west. Kitchens, pantries, dairies, &c. should always be north, where a cooling and refreshing breeze is constantly wafting. Galleries, paintings, museums, also north, where there is a steady light. If the site of the house be low, the first floor should be set so much higher. Cellars contribute to the dryness of a house, if the ceilings and floors be good.

Q. What is the disposition of ecclesiastical edifices?

A. There appears to be a general rule adopted, namely, the longitudinal part of the edifice to be due east and west, and the altar-piece placed at the eastern end.

Q. To what causes may this determination be attributed?

A. Two or three conclusions may be drawn: First, when our two great progenitors were expelled the garden of Eden, we find that the flaming sword was placed at the *Eastern* entrance. Second; that light is more glorious than darkness; and, passing through the gloomy shades of night, our eyes are directed to the new-coming morn. So impressive is this idea, that we find, even to this period, the Persian prostrate in adoration to the rising orb of day. Third, the star of Bethlehem first appeared and shone in glorious splendor in the eastern hemisphere, declaring to mankind the celestial work begun.

Q. What is one principal object in the regulation of the interiors of churches, chapels, and all places of worship?

A. The situation of the pulpit and desk: the whole assembly should be conspicuous to the minister; and also the minister exposed to the congregation.*

Q. How is this to be effected?

A. The pulpit and desks should not be too elevated; as the sound of voice is destroyed to those seated under the galleries, sound always ascending: and to place them too low is an evil equally as great, unless the galleries slope very considerably—so that the minister may be seen and heard.†

Q. What is the system to be adopted in such arrangements?

A. Lateral and transverse sections should be made of the intended building; and the situation of the pulpit and desks being determined on, lines radiating from a given point, (say from four to five feet above the area of the floor, being the height of the reading desk,) and then intersected by the perpendiculars of the sides and front of the gallery, together with other perpendiculars, will at once regulate every seat: this regulation is applicable to every building, either for churches, chapels, theatres, or amphitheatres, of whatever figures they may be; and unless strictly adhered to, no comfort or convenience can possibly accrue. The Cathedral of St. Paul, London, and the amphitheatre of Oxford, present a noble appearance when the sweeping and graduating galleries are occupied by their several companies.

Q. What is the most prominent feature in Practical Architecture?

A. *Proportion*—defined as the relation a whole building has to its parts, and also the relation which these parts bear to the whole building.

Q. On what are the principles of proportion founded?

A. On the laws of nature, and ideas of the subject become familiar by close and habitual observation of her handy works. In a fabric that is built according to the exact rules of proportion, by seeing any one of its parts, as the diameter of a column, or the height of a perpendicular, we may nearly judge of the size of the whole building.

Q. In what light did the architects of Greece and Rome hold proportion?

A. They were very concise in the proportion of their buildings—which were on immense scales; and the several component parts corresponded in magnificence, utility, and strength. Each order bore a peculiar proportion to itself, and a deviation from it would have destroyed the effect of the whole.

Q. What affinity does strength bear to proportion?

A. Strength is the sinew of proportion—this also is afforded from nature—in which the imitation of man has been peculiarly felicitous in the construction of that solitary pile that warns the watchful mariner of his danger off the Eddystone rocks.

Q. What is the figure of this column, the antitype of strength and proportion?

A. Nature impressed the first idea of the constructor, from the semblance of an oak that had stood the wintry blasts and howling storms in long succession of ages unimpaired. The spreading roots held fast the ground, whilst its bole diminished in gradual concave to the summit—and thus the *Eddystone Lighthouse* rises on the unshaken rock, whilst each swelling surge rolls its fury onwards, and threatens in vain the destruction of the mighty fabric. Every architectural design must be based on proportion.

Q. What are the most appropriate forms for modern built rooms?

A. For general habitations, rectangular, which gives the greatest facility and convenience of arrangement, without losing the space, rendered unavoidable, by adopting circular or curved forms. In height they

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* Originally all the pulpits faced the west, that the eyes of the congregation might see all acts of devotion, and look towards the east, where the sun of Righteousness arose. The first deviations from this rule were introduced by the Persians; and the first chapel erected south and north was the chapel of Emanuel College, Cambridge, founded by Sir Walter Mildmay, a distinguished leader of that sect.

† A moderate voice may be heard distinctly thirty feet in the rear, fifty feet on each side, and one hundred feet in front.

should be at least ten or twelve feet. For spacious apartments, a rectangular parallelogram, or oblong, is a convenient figure, and with regard to beauty, every variation in proportion, from nearly a square to a square and a half, or sesquilateral,* may be employed.

Q. What are the proportionable heights of such rooms?

A. In square rooms, the first story may be in height from four fifths to five sixths of the breadth of the side; and in oblong rooms, the height may be equal to the width. The rooms of the second story may be one twelfth less in height than those below; and for a third story, divide the height of the second into twelve parts, and take nine for the height of such rooms.

Q. What is an eligible portion for galleries?

A. Their lengths should be from five to eight times their widths; their heights may exceed the breadths in proportion of a third, or even three fifths, according to their lengths.

Q. What of the introduction of groins or covings in ceilings, as regards height of rooms?

A. Their depths and heights should be additional to the proportions already laid down—giving greater beauty, and still better effect, to the proportions of the whole.

Q. What is to be observed on *Convenience?*

A. *Convenience* comprehends the subject of disposition in a stronger light, in the plan of domestic economy. It is not to be said, because the disposition of a room, in a certain part of the building, is more congenial to the eye, that it is to be placed in that identical spot, rather than otherwise, where convenience is paramount to the whole. Every apartment, from the drawing-room to the scullery, must be considered as to the use for which it is adopted, and then the *internal arrangements*, which constitute the climax of convenience, can be agreeably disposed of.

Q. How is *Beauty* to be applied to architecture?

A. By comparison, and not inaptly to human nature. Man is said to be beautiful, but Heaven's master-piece is recognized in its after-production. Beauty is comprehended under two heads—that which is *powerful, proportionate, robust*—and that which is *delicate* and *effeminate*. Hence the appellation to the two orders—*Herculean* to the *Doric*, from its lusty shape—and *Female* to the *Ionic* and *Corinthian*—distinguishing the former as a *matron*, from the curling volutes, resembling bands of hair, and the latter as a *virgin*.*

Q. What are the distinguishing features of beauty in architecture?

A. Harmony, symmetry, variety, and native purity. A redundancy of ornament will destroy the most gigantic, or the most delicate, superstructure raised by the art of man; purity and consistency of style being the quintessence of the whole.

Q. What is to be comprehended by *Decorum?*

A. The conducting of the several buildings according to their prescribed orders and authorities. In decorum three things are to be observed, namely, *design, custom*, and *nature*.

Q. What is meant by *Design?*

A. Not merely in making a pretty drawing on paper, and pleasing a fanciful eye, but in the choosing dispositions suitable to the character of the building: thus, other elevations should be executed for a theatre than should be chosen for a place of worship.

Q. What does *Custom* imply?

A. That mode of architecture which the laws of science and mathematics have so well established—yielding, in many instances, to localities and circumstances. In fact, custom implies the doing of those things which are usually done; as the ornamenting the outsides of edifices whose insides are intended to be rich and splendid.

Q. What of *Nature?*

A. The selection of different situations for different rooms, according to the several prospects afforded.

Q. What is to be interpreted by *Economy?*

A. Correct measures, convenient forms, and magnitudes of building. It also signifies a regard to avoid all redundancy of material. Strength is not constituted, on every occasion, by ponderous mass—on the contrary, this produces weakness in itself, and to all

* A figure bearing the proportion as 6 to 9.

* According to Vitruvius, there is an analogy between the proportions of the human figure and those of the orders. "The symmetry and proportion," says this father of the art, "were derived from the human figure—the capital representing the head, the base the feet, and the shaft the body;" and so far is this idea of the reference of the members of architecture to those of the human body carried by Michael Angelo, that he declares a knowledge of anatomy to be indispensable to an architect, who without it must be necessarily ignorant of his profession. Sir C. Wren was intimately acquainted with the proportions, dependences, and relative bearings of the several parts of the animal structure: hence that harmony of design, and proportion of his works, even in imitation of architectural beauties. Indeed, so rigid were the Lacedæmonians in the reciprocity of art and human nature, that the chambers of the females were adorned with the most exquisite models of loveliness and symmetry, that, having their imaginations filled with the ideas of beauty, they might bring forth a beautiful race.

component parts. Therefore, simplicity of construction is the best criterion to be introduced for economy, strength, and durability.

ROOFS.

Q. What is to be comprehended by the term Roof?

A. A roof is the exterior covering of all buildings.

Q. What are the several descriptions of antique roofs?

A. The ancients, in countries where it seldom rained, constructed roofs quite flat; which plan is still continued in countries between the tropics.

Q. Did the Greeks make any alterations?

A. Yes; they inclined their roofs, as appears from several ancient remains, about one eighth or one ninth part of the span; as shown by their pediments: from which, roofs of this inclination are now designated the *pediment pitch.*

Q. What elevation did the Romans make in their roofs?

A. They gave an inclination, in height, to the roofs, from one fifth to two ninths of the span, and also introduced cupola roofs.

Q. After the fall of the Romans, what alterations took place in the roofs?

A. In the northern part of Europe high-pitched roofs began to be adopted; and that was the standard form, which was an equilateral triangle.

Q. What are the advantages of high-pitched roofs?

A. They discharge rain and snow more quickly—are not so easily stripped by the wind—the rain is not blown between the slates—and, from their approach towards perpendicularity of pressure, they are not so great a burden to the walls; but they are more expensive than low roofs—requiring longer and stronger timbers, and a greater surface of covering material.

Q. Of what advantage are roofs?

A. They not only form the covering of the house, but are the principal ties of the building, when skilfully executed in connection with interior walls.*

Q. What is the plan of modern roofing?

A. It partakes of numerous ramifications from original styles; as the dome or cupola roof, the span roof hipped, the pediment roof, the camber roof, the valley roof, &c.

Q. What is the construction of the dome or cupola roof?

A. The dome roof consists of segmental ribs, answering as principals, springing from the ends of the ties or transverse beams, and terminating at a central point, on the summit of the roof, from which they all radiate at equal distances. In many instances the radiating point is intersected by a circular and horizontal plate, a little below that point, against which the heads of the ribs butt—forming an area for the erection of an additional perpendicular elevation. The ribs are supported and strengthened by braces, collar beams, &c. with circular purlins, plates, small rafters, &c. completing the entire form.

Q. What is the span roof?

A. The height is one third of its breadth: it includes *ties*, which are the long transverse pieces, stretching across from wall to wall, of certain thickness and depth—*principals*, varying in number, being two pieces of timber, of like scantling to the ties, meeting each other in the angles, their heels being secured to the ends of the ties, either morticed and tennoned, or chased: *half principals* introduced at the centre of the ends—*hips*, pieces of timber of equal dimensions to the principals, forming the extreme angles of the roof, their heads being secured in the outer pair of principals, and the heels let into *half ties—king post*, a perpendicular piece of timber into which the principals are joggled, and the heel of the post tennoned into the tie—*queen posts*, one on each side of the king post, at equal distances, secured and securing in the same manner—*struts* or *braces*, placed diagonally between the principals and ties, and butting alternately against king and queen posts, to give greater strength to the roof—*purlins*, longitudinal pieces of wood extending the whole length of the roof, on either side, at the extremities of the roof, in two, three, and four rows, to receive the *rafters* at right angles upon them, whose heads are chased to the *ridge piece* in the summit of the roof, running longitudinally, and their heels resting on *pole plates* and *eave boards*. These constitute the entire roof—supported all round on the walls by *wall plates*.*

Q. What is the construction of the pediment roof?

A. It may be executed in the same manner as the span roof, or common gable.†

* Some idea may be formed of the success with which scientific knowledge and experience may be employed in the construction of roofs, when it is asserted that roofs have been constructed sixty feet wide, although they have not contained a single piece of timber more than ten feet long, and four inches square; and be it observed, that the lighter a roof is constructed, the better it is, upon every consideration.

* The common gable roof is of nearly the same description—the king and queen posts being substituted by collar beams and struts to admit of garrets.

† There is, however, a plan lately introduced in the roofs of the Coburg Theatre and some warehouses at

Q. What is the camber roof?

A. It is so called on account of its upper surface *cambering* or rising externally, for the water to run off, and is principally used in churches—sometimes in villas and mansions. It consists of ties, into which the heels of the principals are tennoned, whilst their heads are tennoned into the struts which connect the upper ties of the roof, upon which the camber slips are laid. King posts, queen posts, braces, and rafters, are severally introduced, whilst purlins, rafters, &c. connect the whole together.

Q. What are hip and valley roofs?

A. They are of lighter construction, frequently called M-roofs, and are used for terraces, &c.—generally concealed by pediments, copings, &c. and admitting of no rooms within them.*

Q. What is the curb roof?

A. This is a high roof admitting of chambers, and better adapted for this purpose than the span roof, having a greater area. The principals consist of two lengths, forming an angle; the lower piece, which limits the height of the room, is tennoned into the ties, nearly at right angles; and the upper part of the principal inclines to the apex of the roof. The unison of the parts is effected by a collar beam, with king posts, braces, purlins, &c.

Q. What is the lean-to roof?

A. A very common roof in use, attached to a main building, and consists of principals, ties, purlins, &c.

Q. Of what materials are roofs constructed?

A. Wood, and also iron; of the latter material was the roof to a manufactory at Millbank, and the Royalty Theatre, Commercial road, London, both of which unfortunately gave way, destroying lives and property to a great amount.

Q. With what materials are roofs covered?

A. Slates, pantiles, plaintiles, also boards, with lead, tin, copper, and sometimes canvassed, tarred, and strewed with shingles.

Q. What is centering, cradling, &c.?

A. The construction of frame work for semi, segmental, elliptical, and pointed arches, to bridges, tunnels, vaults, &c.; and this forms a very important feature in carpentry, in connection with roofing. Its purport is to support the stone or brick-work of the arches, until the whole is arranged, and requires to be of extraordinary strength, as it has to support the weight of every stone or brick singly, until the key-stone is introduced; when, by this junction, the arch is secured of itself, in the whole weight being brought vertically, and the cradle is ultimately removed, to supply the formation of any other arch.

Q. How is such centering constructed?

A. By ribs, forming the curvature of the arch, placed about two feet apart from each other in their sweeps. The heels are tennoned into, or bolted to, the plates resting on the piers; whilst with ties, braces, chocks, &c. the whole is firmly united by iron bolts, screws, plates, &c.*

NOTE.—The description of the arched, pendant, trussed roof, &c. has already been given and exemplified under the head of English Architecture.

New Analysis of Corrosive Sublimate and Calomel. By Dr. TURNER. [From the Repertory of Arts.]

BICHLORIDE OF MERCURY.—The corrosive sublimate of commerce was purified by repeated crystallization from distilled water, and was then well dried at its subliming temperature. It might in that state be sublimed without giving any trace of humidity. Of this chloride 137·595 grains were dissolved in warm water, and directly decomposed by nitrate of silver; and the chloride of silver was washed with water acidulated with nitric acid, and amounted in the fused state to 144·374 grains, equivalent to 35·659 of chlorine. The bichloride of mercury would hence seem to be composed of

Mercury -	101·936	201
Chlorine -	35·659	70·31

giving 35·16 as the equivalent of chlorine. This result led me to suspect some imperfection in the method of analysis; and I accordingly found that some of the bichloride of mercury is apt to combine with the chloride of silver, and being expelled when the latter is fused, a loss of chlorine is occasioned. To avoid this error, the bichloride was decomposed by lime, which was prepared from Carrara marble, and was quite free from muriatic acid. The requisite quantity of lime, previously slacked, was mixed with a little warm water, and the solution of

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Dock Head, quite novel, and remarkable for its simplicity and strength. Instead of the ties running transversely, two ties or braces are placed at angles with the principals, intersecting each other in the centre, and scored; the foot of the tie is chocked and bolted to the foot of the principal, whilst the head is tennoned into the opposite principal, one third distance from the top, the opposite tie and principal corresponding. The whole is secured by three vertical bolts, plates, and screws, one in the centre, and one on each side.

* It is to be observed, that where roofs are in part or wholly concealed by pediments, copings, &c. gutters are thereby formed between the angles; which have, in carpentering, gutter-boards, bearers, &c.

* The late centering to the arches of the new London Bridge was a fine specimen of the art.

a known weight of corrosive sublimate gradually added, shaking the mixture after each addition. After a short digestion and filtration, the liquid was neutralized by nitric acid, and the chlorine determined by nitrate of silver in the usual manner. Every trace of muriatic acid may thus, without the necessity of boiling the materials together, be transferred to the lime and rendered soluble, while the oxide of mercury, of an orange color, is left with the excess of lime. In this way I obtained the three following ratios:

	Mercury.		Chlorine.	
1st	113·441	201	39·748	70·428
2d	113·149	201	39·723	70·564
3d	112·585	201	39·423	70.43

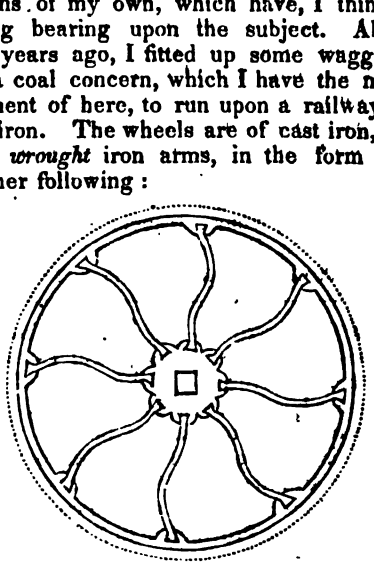
According to these results we obtain 35·214, 35·28, 35·26, as the equivalent of chlorine.

CALOMEL.—The proto-chloride, though much more stable than the protoxide of mercury, is very subject to change. I believe it is impossible to sublime calomel without a portion being resolved into mercury and corrosive sublimate; and after washing calomel, so as to remove the adhering bichloride, the heat subsequently required for rendering it quite dry causes a fresh production of corrosive sublimate. I selected for analysis the pulverulent white calomel prepared by Mr. Howard, and dried it by exposure to a continued heat of 300° Fahr., at which temperature it undergoes no appreciable decomposition, and contains only a trace of moisture. But that trace of humidity affects the ensuing results with a small error, the tendency of which is to make the equivalent of chlorine smaller than it is. The following are the ratios of three careful analyses, which were made by means of lime, as in the analysis of corrosive sublimate:

	Mercury.		Chlorine.	
1st	100 048	201	17·602	35·361
2d	95·154	201	16·721	35·32
3d	76·565	201	13·473	35·37

Experiments on Wheels with Straight and with Curved Arms. [From the London Mechanics' Magazine.]

SIR,—Having read some remarks, by two or three of your correspondents, in regard to springs as applied to locomotive engines and other heavy carriages, and noticed the suggestion thrown out, that the spokes or arms of the wheels might possibly be made of such materials, and of such a form, as of themselves to counteract sufficiently the jolting of the superincumbent and progressing weight, and so dispense with the costly springs at present used, I am induced, by the perusal of these speculations, to send you an account of some experimental observations of my own, which have, I think, a strong bearing upon the subject. About five years ago, I fitted up some waggons, for a coal concern, which I have the management of here, to run upon a railway of cast iron. The wheels are of cast iron, but have *wrought* iron arms, in the form and manner following:



In giving this curved form to the arms, I did not at the time contemplate that they should act as springs; though, as will be presently seen, it has been attended with great advantage. The ordinary weight of these waggons, when full of coal, is about 3 tons 15 cwt., waggon included. On this same railroad, an iron company have the privilege of conveying their iron ore, the waggons employed for which purpose are entirely of cast iron, with straight arms, and, when loaded, weigh (waggon included) something less than 3 tons. In the course of last summer, I found it necessary to repair a wooden bridge of considerable extent, over which both kinds of waggons had to pass, during the time these repairs were going on. To the great surprise of the workmen, they found that our own waggons, although the heavier, as above stated, produced less effect on the bridge than the others. This I could only attribute to the difference in the form of the arms of the wheels; and every observation which I have since made serves to confirm me in this conclusion. I have rode alternately on both sorts of waggons, when at their greatest speed, and certainly a sensible difference is felt to the advantage of the crooked and slender arms. The noise also which they make is much less. It may be proper to add, that the wheels with the wrought iron arms stand their work uncommonly well—much more so than the others. The fact is, we have not had one broken or worn out during the five years that they have been in constant use.

Should this article have the effect of turn-

ing the attention of some of your ingenious readers to the subjcct, it might be of service. Our wrought iron arms are 5 inches wide, and scarcely ⅛ of an inch thick. Supposing, then, that, instead of being of wrought iron, they were made of steel of suitable quality, they might be made thinner than ⅛, and with a greater number of arms: a much better form of curve, too, than that I have employed may very possibly be suggested.

I am, sir, yours, respectfully,

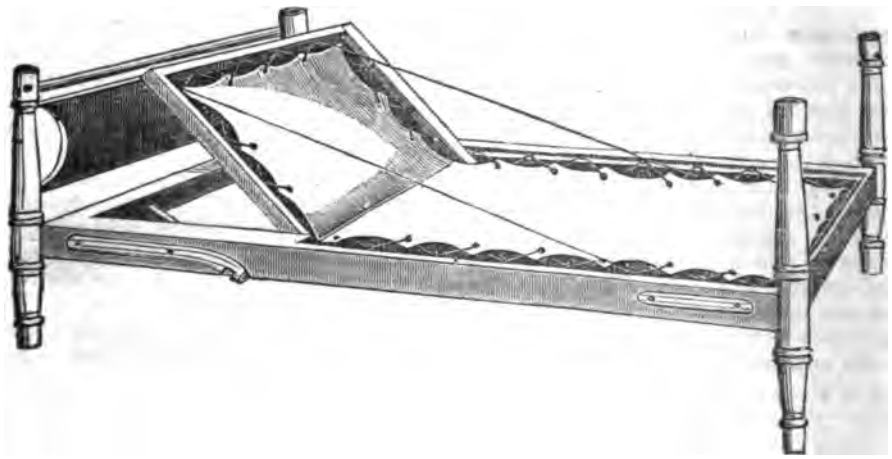
Wm. Brough, Mineral Surveyor.

Cwmneath, Glamorganshire, Dec. 15, 1833.

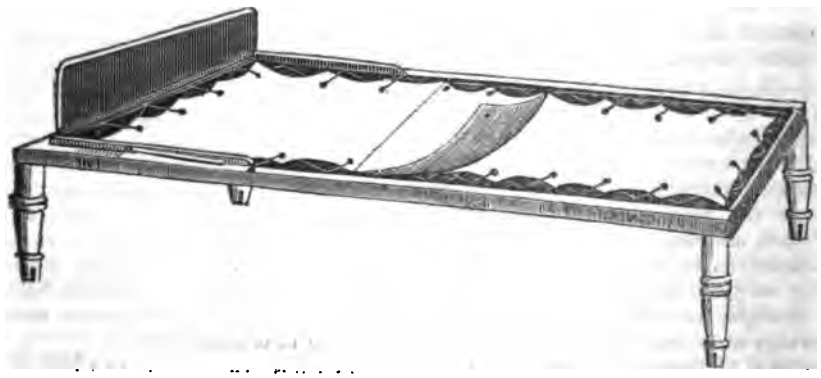
New Invention.—A gentleman in Boston, who owns a large chemical establishment, has discovered a new species of fire, which produces a most intense heat. It is produced by the mixture of tar and water. With this kind of fuel a steamboat can cross the Atlantic, with the greatest safety. The discoverer declares that he can carry a steamboat from Providence to New-York, by using this fuel, for five dollars. It is said that the invention of the cotton gin doubled the value of every acre of land in the southern States, and we are of opinion that the discovery above mentioned will double the value of the steam engine. It will be especially important to the engines which are employed upon railroads, and will remove one of the greatest obstacles to the general use of locomotives upon our common roads. —[Taunton Reporter.]

Woolley's Patent Improved Bedstead for Invalids.—Mr. Woolley has been some time constructing a bed for invalids, which will also answer as one for ordinary use. Fig. No. 1 represents the ordinary bedstead improved, either as a French bedstead or field-post one, raised to suit any elevation in the centre, to make it a chair, supported by cords, or rods of cast iron.

No. 1.



No. 2.



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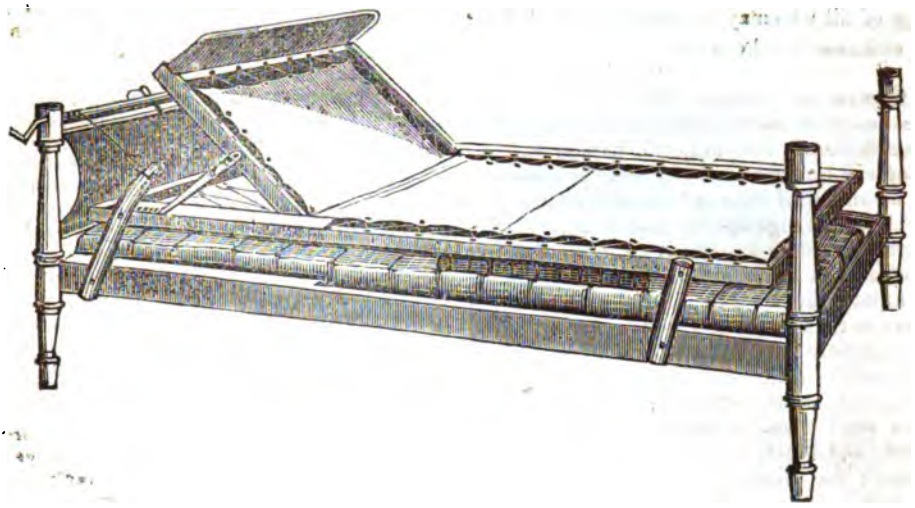
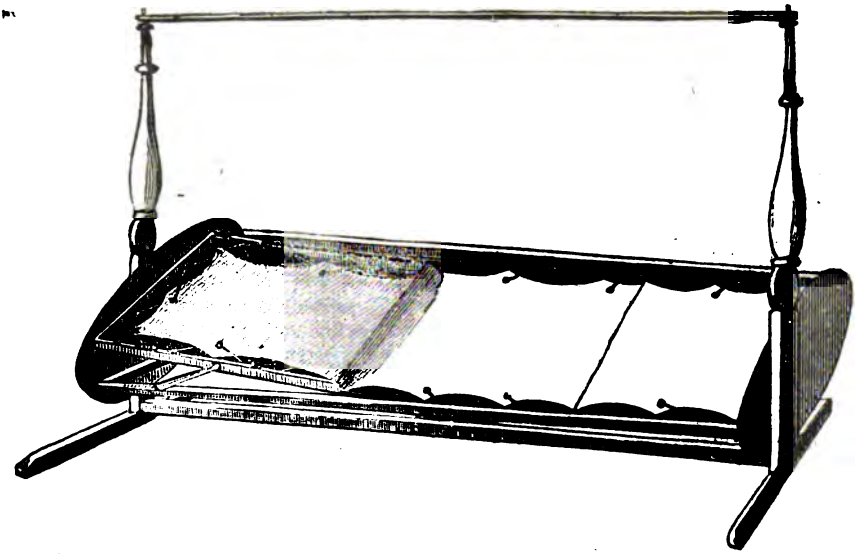


No. 4.



No. 2 is an ordinary cot bedstead, which, divested of its legs, is made advantageous to the invalid when placed on the top of No. 3. The sacking of No. 2 is used as a sheet when there placed, and can be tightened quickly or not, as may be necessary, which, in cases of fractures, is sometimes of great importance; under No. 2, when moved to the top of No. 3, is a mattress, and the whole is moved by levers, to two of which a cord is attached, and by means of a small crank can be raised or lowered, as best suits the patient's inclination, by a child of 10 or 12 years.

No. 4 consists of No. 2 placed on a frame similar to the swing cradle, by which those who are afflicted with ulcers, &c. can be frequently turned with ease, and without incurring additional pain.

The price does not much exceed the ordinary price of bedsteads. Mr. Woolley has shown us several certificates from some of the most eminent medical men in this country, stating that in their opinion his invention

is calculated greatly to mitigate the sufferings of all who may be confined to their beds by sickness or otherwise.

Damascus Steel.—The steel of which the beautiful sword blades of Damascus are manufactured has hitherto baffled all attempts at imitation. It is generally supposed to be made of slips or thin rods of iron and steel, bound together by iron wire, and then melted together by heat. The most skilful workmen of other countries have attempted to imitate this process, but in vain: so that there is reason to think that the secret of the manufacture has not yet transpired. The color of the Damascus blades is a dull bluish gray, and scarcely exceeds in hardness common steel from the forge. It is difficult to bend, and when bent does not resume its shape; the principal character, however, is its *water*, or a peculiar wavy appearance running from the hilt to the point in narrow lines, the thickness of a harpsichord wire, which never cross each other. These waving lines arise from a slight difference in the degree of polish occasioned by the unequal action of acid upon the steel; any weak acid would produce this effect, but at Damascus sulphate of alumine is the substance used. This appearance of waving lines has been imitated by a false damasking, or etching, but the genuine Damascus blade is distinguished from the false one by the obliteration of the lines in grinding, which takes place in the latter. In the real Damascus blades, grinding nearly removes the water, but it immediately re-appears by rubbing the blades with lemon juice.

Sympathetic Ink.—The following affords a sympathetic ink very far superior to any, as yet, in use. Dissolve a small quantity of starch in a saucer with soft water, and use the liquid like common ink: when dry, no trace of the writing will appear upon the paper, and the letters can be developed only by a weak solution of iodine in alcohol, when they will appear of a purple color, which will not be effaced until after long exposure to the atmosphere. So permanent are the traces left by the starch, that they cannot, when dry, be affected by Indian rubber; and in another case, a letter, which had been carried in the pocket for a fortnight, had the secret characters displayed at once, by being very slightly moistened with the above-mentioned preparation.

Heat.—It has been said by an astronomer, that a globe of red hot iron as large as our earth would scarcely cool in 50,000 years. If this be true, then the comet which appeared in 1680, cooling a hundred times as fast as the hot iron, its heat being actually 2,060 times greater, would take a million of years to become perfectly cool, admitting it to possess a quantity of matter equal to that constituting this earth. That the comet alluded to was solid, cannot be doubted, as Sir Isaac Newton clearly demonstrated that in its passage through the neighborhood of the sun, it must have been dissipated, had it not been of solid compact substance. In its perihelion, Dec. 8, it was observed to be to the distance of the earth from the sun as 6 to 100. The sun's heat in the comet, at that time, was to the heat with us at midsummer as 1,000,000 to 36, or as 28,000 to 1. Had the comet consisted of exhalations of the sun, as some astronomers of the day intimated, it must have been completely dissipated; for the heat of the sun, it is generally allowed, is as the density of his rays, or in other words, reciprocally as the squares of the distances of places from the sun.—[Scientific Tracts.]

Atmospheric Pressure.—The hamlet of Antisana, which is 13,500 feet above the level of the ocean, is the most elevated inhabited place on the globe. Condamine and Bouguer, with their attendants, lived three weeks at an elevation of 14,604 French feet, where the barometer stood at 15 inches 9 lines, and, consequently, the pressure on the body was 16,920 pounds.

The pressure on the body of a common sized man, whose surface is about equal to 12 square feet, is 25,056 pounds; and the pressure on the surface of the whole earth is equal to about 11,642,019,840,000,000,000 pounds.—[Ibid.]

Strength of Cordage.—The Boston Hemp Manufacturing Company have lately put up a machine, at their ropery on the Milldam, for the purpose of determining the strength of their cordage, spun in the common method by hand. A great number of experiments have been made by breaking ropes of various sizes and kinds on this machine, and the following exhibits the average result of these trials. The figures show the number of pounds required, *by each inch of the square of the girt of the rope, to part it.*

Whale line spun by hand, best that could be produced,	776 lbs.
Whale line spun by machines,	994
Russia bolt rope, 1st quality,	723
Bolt rope of machine spun yarn,	915
Running rigging, 1st quality Russia,	442
Running rigging, American, spun by hand,	631
Running rigging of machine spun yarn,	717
Cotton line,	604
Coire rope,	215
Rope made of Manilla hemp,	610
Rope made of New Zealand flax, *Phormium Tenax*,	722
Mean of all hand spun hemp rope,	638
Mean of all machine spun hemp rope,	875

Showing the machine spun rope to be 36 per cent. stronger than the hand spun. If, however, we reject the trials on Russia cordage, which is very weak, the superiority of the machine spun ropes is reduced to 24 per cent. over all others.

In no instance whatever, was the trial on machine spun ropes made on selected specimens, but the pieces to be tested were taken from common coils as made for use. Indeed, it happened that the machine spun ropes, except the whale lines, were made of hemp inferior in quality to that usually wrought in the machines. The modulus of cohesion, of the strongest ropes in these experiments, is 30,700; or a rope of this strength could be let down into a pit 30,700 feet, or 5-8ths of a mile, before it would be broken by its own weight. A rod of iron can sustain itself, according to Mr. G. Rennie, only for a length of 19,700 feet.

On the 27th of March, by the politeness of Mr. Treadwell, we witnessed the operations of the machinery for preparing the hemp and spinning the yarn; and we were also shown the method of impregnating the ropes with tar, which is done uniformly throughout their whole thickness, the tar being kept at a temperature below the boiling point. The ropes made of these yarns have the appearance of being *stained* rather than *tarred.*

The superior strength of the ropes made from yarn spun by machinery appears to consist in this, that the fibres in the middle of the yarn are nearly of the same tension as those of the outside, whereas, in the yarn spun by hand, they are much more tense in the middle; and the short fibres being the first to give way, the whole stress is thrown upon the outside ones, which, being fewer in number, consequently cannot bear so much strain as a rope made up of fibres of equal tension.

The machine for trying the strength of ropes is so constructed as to try them fairly and accurately. The following experiments on the strength of three ropes were tried in our presence, and we have no doubt of their correctness.

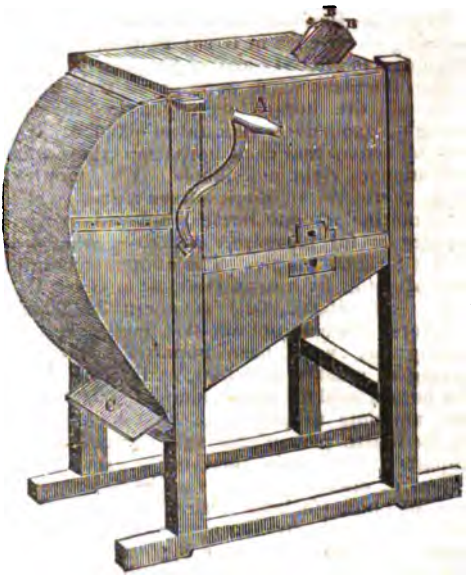
No. 1. Whale line spun by hand—girt 2 inches; broke by 2240 pounds.

No. 2. Whale line made by Boston Hemp Company, spun by machinery—girt 1 $\frac{7}{8}$th inches; broke by 3520 pounds.

No. 3. Running rigging made by the Boston Hemp Company—girt 2 $\frac{1}{8}$th inches; broke by 3440 pounds.

As No. 2 was one seventh smaller than No. 1, we should add 502 pounds to the weight it actually bore, making 4022 pounds, for the weight it would have borne, if it had been of the same size as No. 1: consequently it was 64 per cent. stronger than No. 1. Again, No. 3 was one ninth larger than No. 1; we must therefore deduct from the weight it actually bore 382 pounds, leaving 3058 as the weight it would have borne, had it been as small as No. 1. It was therefore 25 per cent. stronger than No. 1.—[The Mechanic.]

Corn-Shellers, Corn-Crackers, and Turnip-Cutters. [Communicated for the New-York Farmer and American Gardener's Magazine.]



Among the machinery which mechanical ingenuity has furnished the farmer, to expedite farming operations, is the Corn-Sheller. They are constructed to shell either one or two ears at a time. They require two persons, and will shell perfectly clean, and nearly as fast as one can put in the ears; consequently the number of bushels in a day must be very considerable. Some of them, as in the present drawing, have the shelling apparatus incased, to prevent the corn from being scattered. B B are the two openings into which the ears are dropped; A, the turning crank; C, the opening at which the corn comes out. The prices for substantially built machines vary from 8 to 15 dollars.

H. Huxley & Co., 81 Barclay street, have affixed to the Corn-Shellers a simple apparatus for cutting turnips and potatoes for stock. They are also appending one for cracking the corn.

Steam applied to Agricultural Purposes.—We have heretofore expressed our opinions on this subject. We now state, that if the scientific ingenuity and the capital of this country could be combined, and steam immediately applied to agriculture—and that, if prejudices should retard its application in Europe,—we should, in comparatively few years, cause every principal nation in the world to crush by the weight of their own institutions. But En-

rope will, and *must*, have the plough driven by steam. From an article in the Quarterly Journal of Agriculture, we make the subjoined extracts.

From the Parliamentary returns, the horses running in coaches in Great Britain, in 1828, amounted to 178,841; and we are perhaps much within the mark when we suppose that these, with all the horses employed in drays or draught, exclusively amount to 600,000. It is said by some, that each horse consumes what will support eight individuals. The suppression, therefore, of these horses alone, (which does not include one horse employed in agriculture or for pleasure,) will save what will feed 4,800,000 people. The annual consumption of grain, by human mouths, in Great Britain, (viz. 16,000,000,) is about 32,000,000 quarters, of which not one-twentieth part has, during any year, been imported. But the saving of what would feed, by the removal of the horses used for transit alone, 4,800,000 people, amounts to more than what is consumed by the fourth part of the said population. If importation of grain, then, to the very limited extent of one-twentienth, viz., 1,600,000 quarters, has hitherto been deemed an evil of no little magnitude by the agricultural interest, what will they consider a system which will abridge home consumption equal to one-fourth, viz. 9,600,000 quarters? At first sight this will appear to the agriculturist as involving more certain and complete ruin than even that which would follow the repeal of the corn laws. But this is taking a narrow, a prejudiced view of the matter.

The application of steam to purposes of husbandry will so cheapen the cost of production, as to reduce the price of food with remuneration to the growers. It is well known, that the expense of horses forms the principal item in the outgoings of the farmer. The late Dr. Colquhoun, so far back as the year 1812, in the estimate which he makes of the new property created annually in Great Britain and Ireland, taking each kind of grain at 50 per cent. less than the average prices in the public markets of the 12th September, states the crop of hay, grass, straw, and vetches, as amounting in value to £89,200,000.

And the portion of this consumed by horses was as follows:

Horses in Great Britain and Ireland, estimated at 1,800,000, at 45s. each for grass,	£4,050,000	0 0
For hay, at £6 each, - -	10,800,000	0 0
For straw, at 5s. each, - -	450,000	0 0
For beans and peas, - -	2,640,666	13 4
No separate item is given for corn, but taking the half of that consumed by animals generally, as consumed by horses, viz., £14,790,000,	7,395,000	0 0
We have - - - -	£25,335,666	13 4

—which is substracted from the above, purely to support the brute labor which it is now possible to supplant, in a great measure, by steam.

When it is farther considered how much horses have multiplied since the period mentioned, it is perhaps speaking greatly within bounds, when we suppose they are maintained at a yearly expenditure of £30,000,000. It is not difficult then to perceive, how the suppression of horses, either in whole or in part, will economise a saving in farm management sufficient to effect a great cheapening of agricultural produce with advantage to the producer, and benefit to the consumer.

Though difficulties exist in the minds of agriculturists, who have not turned their attention to the subject, as to the possibility of extending steam to husbandry purposes, no difficulties exist in the opinions of many eminent machinists who have turned their attention to it. We have had conversations with several patentees, who have each assured us that there are no practical difficulties in the case, provided there was any inducement for them to direct their skill to such a species of machinery. Mr. Phillips' getomic apparatus, the model of which we have seen, though far from being a perfect machine, is yet sufficient to show that a little farther simplification is all that is required to render it such. We are happy to say, that, in our notions respecting steam-ploughing, whether as regards its practicability or importance, we are corroborated by a Fifeshire farmer, who, in a letter of the date 24th December, 1833, published in the Fife Herald, remarks, "that at present, when the ingenuity of man is upon the stretch to devise means to abridge human labor, and add to the comforts and intelligence of a redundant and still increasing population—when, by our absurd laws, the manufacturer is under the necessity of giving an extravagant price for the first necessaries of life—when industry is fettered, and the growing resources of the country are circumscribed, our tenantry wasting their time and means, and crouching under the power of their proprietors, on account of a corn monopoly,—I wonder it never struck some of our agriculturists that they might, like the manufacturers, endeavor to undersell their neighbors, and drive them out of the market. I know it will be said, that it is impossible—but what I am going to suggest is a farther extension of machinery, to assist us in keeping ourselves ahead of our neighbors, and that is the application of steam to the working of ploughs. At present, it requires nearly the half of the produce of a farm to pay the necessary expenses, and a great part of that goes to the keeping of horses, harness, &c. Now, it the farmer could get a steam-engine to work his ploughs, harrows, and rollers—thrash and shear his corn—cast his drains, and rid his land of large stones,—he would be able to pay his present rent, although there were no corn-laws, and grain one-third cheaper than it is."

We have gone into this detail, not because we advocate the application of steam to general locomotive purposes, merely from the love of change, without any other reason than that change is the order of the day: no, but because there are numerous weighty, and what ought to be *imperative* reasons for the agricul-

tural classes giving this matter their deep and serious attention. From the whole course of events, no man can be so blind as not to perceive that, upon the subject of the corn laws, the agricultural and manufacturing classes are about to come shortly into a fearful collision. Cheap bread is a thing that our starving and oppressed people must have, either by a cheaper system of cultivation at home, or by importation of corn from abroad. The alternative is the choice between the life and the death of the State. For surely it is madness amounting in degree to theirs whom the ancients conceived were doomed to perish, to suppose that cheap bread, by a method that will ruin our domestic agriculture, will not precipitate the country into that state of social disunion which the whole tendency of our affairs shows to be in course of progression. Now, let it be supposed that steam has had nothing to do in maturing this condition. During the last quarter of a century, it has been applied to what may be called *physical* purposes only, *i. e.*, to purposes which have materially abridged manual labor, and multiplied almost indefinitely every species of commodity, whilst it has not been applied to any one purpose that has increased human labor, or saved the consumption, and cheapened the production of food. Consequently there has been a gradual disapproximation between the necessaries and the conveniences of life, until, after nineteen years of peace, and what ought to have proved financial recruitment, it has reached an extent which has unbalanced consumption and production to a degree which is paralysing all commercial and agricultural transactions, fearfully increasing pauperism and crime, fomenting sedition, and threatening the peace, order, and best interests, social and civil, of society.

The extension of steam to *economic* purposes, *i. e.*, to purposes which will permit the removal of brute labor, will remedy the evils arising from its partial application; for, as we have shown, it will save and cheapen food, and that by a way which, over and above its improvement of internal communication, will improve the coal trade and iron trade, those pillars upon which the prosperity of the country is said to rest, as well as every department of manual industry. Applied exclusively to physical purposes, machinery as yet has, with all its advantages, been attended by evils far from being partial. Extended further to economic purposes, the good that will follow will not be short of universal. Hitherto its abuse, that is to say its former application, alone has been pernicious; now its use, that is to say, its latter application, will be commensurately beneficial. Machinery has made goods,—machinery also must make a market. The existing circumstancees of society demand this, otherwise all will terminate in convulsion.

There is not a laborer in the three kingdoms who does not feed his belly at the expense of his back. This is an evil of no trifling character, for it is one which affects the entire industry of the country; and farther, it is one which, for the interest of all parties, ought to be removed without loss of time.

In order more effectually to promote this object, and carry the project extensively into operation, A NATIONAL INSTITUTION OF LOCOMOTION, unconnected with any trading company, is now in progress of being formed to promote the application of steam to general purposes of transport and husbandry, and to supply the desideratum which has long been experienced of there being no metropolitan association, in connection with the various companies and local societies throughout the united kingdom, formed for the advancement of commerce and agriculture.

When we consider how exigent is the WANT which steam applied to economic uses is commissioned to alleviate, and how reckless in its consequences, as that volcano indicates whose eruptions are now nightly visible in the farmyards of some district or other of the country, we consider it fortunate that, if CHEAP BREAD be wholly unavoidable, it can now be procured in a way that makes it wholly desirable. The bane of having prices reduced by steam transport, and the antidote of providing for the same by steam husbandry, are both before our agriculturists. We cannot suppose that they will allow the one to be introduced unaccompanied by the other. In the hope that this will be the case, we cannot conclude this paper without congratulating all orders of our fellow-subjects upon the bright prospects which the general application of steam to brute labor purposes opens upon us. At a moment when the resources of the country are no longer adequate to the wants of our population, "WHEN A RESTLESS SPIRIT OF DISCONTENT IS EVERYWHERE ABROAD," and cheap food of *home growth* is a *sine qua non* to an ameliorated condition, this beneficent agent steps in to accomplish what could not have been effected by any *external* process whatever. The speedy and general introduction of steam cultivation is all that is required to make cheap bread in Britain, in a way that will reduce no one to destitution in Britain. If our industrious classes must still earn and eat their bread by the sweat of their brow, they shall nevertheless eat it in plenty, and in contentment. Under the social economy which the extension of steam to the purposes of animal labor will allow, it shall no longer be said that the wealthiest empire in the world is also the most wretched one, or that, with all our boasted wisdom in science and art, we are unwise in that which not rightly to know is misery and unhappiness! The better policy of the age of steam must be to make millions rich instead of the units,—to render monopoly the property of the state and not of the stock-jobber,—to comfort a thousand happy homes, instead of building up one bloated capitalist. Steam, which, confined to physical purposes, hitherto has wrought such marvels, extended further to economic uses, can achieve all this, for by *home means*, equalizing the price of necessaries and conveniences, IT WILL ADJUST PRODUCTION AND CONSUMPTION; the unbalanced condition of which alone has deranged the currency,—paralyzed transaction,

—abridged industry; and, in a word, occasioned all those evils which at length have produced a nation divided into usurers and paupers, to the danger alike of the constitution, the altar, and the throne. R. B.

Patent for an Improvement on the Mode of fixing Valves on the Boilers of Steam Engines. Granted to DAVID B. LEE, city of Philadelphia, January 23.

The safety valve here patented is, we are informed, "a fixture for boilers for steam engines, to prevent *collapsation*, resembling the common safety valve, except that it opens in by the pressure of the atmosphere." And "the part claimed as an invention, or discovery, is not the particular form of the valve, but the general plan of fixing a valve, or valves, to boilers of steam engines, which shall open with an external pressure, to prevent collapsation."

A very little reading would have shown to the patentee the antiquity of his invention, as an account of it may be found in most, if not in all, of the numerous histories of the steam engine. We could take from our shelves a dozen books from which to quote upon this point, and could refer to numerous patents in which such valves are noticed. In the article *Steam Engine*, in Rees' Encyclopædia, after speaking of the safety valve in Watt's engine, it is observed, that "there is another valve of safety for the reverse of the object of the first mentioned safety valve; it opens internally, and is balanced by a small lever, and a sufficient weight to keep it shut, until the pressure of steam within the boiler becomes much less than the external air, which then forces open the valve, and enters into the boiler till the equilibrium is restored. It is evident that this valve can never be necessary so long as the engine is at work; but its use is to prevent the sides of the boiler being crushed in by the weight of the air, when it has done work, and the steam within it cools and condenses."

This kind of valve has, in fact, been applied to hundreds of boilers, stills, &c. With the kind of boilers which we now ordinarily use in steam engines, valves of this kind are not employed, for the simple reason that they would be of no use. Our cylindrical iron boilers do not collapse by the pressure of the atmosphere, which they would be able to sustain, even if perfectly exhausted; nor is the collapsing which frequently takes place, a collapse of the boiler, as the patentee appears to suppose, but of that of the flue which passes through it, and which is forced in, not by the pressure of the atmosphere, but by that of high steam, occasioned in general by the water being allowed to descend too low, which admits of the heating of the upper part of the flue, and the consequent diminution of its strength; it then yields readily to a pressure, which, under ordinary circumstances, it would have sustained most effectually.—[Journal of the Franklin Institute.]

The following is a specimen only of letters we are continually receiving; it was intended to be inserted before.

To the Editor of the Mechanics' Magazine:

SIR,—Please accept my thanks for the number of the "Mechanics' Magazine and Register of Inventions and Improvements," which you were so good as to hand me. I have long desired to see the work, and have now examined it with some attention. I consider it a most valuable auxiliary in the cause of improvement, and a great aid to the progress of the arts amongst us. The great variety, as well as the extent and importance of the information it presents, render it a most desirable work for any mechanic.

The time has at length, I hope, arrived, when *practical men*, whether mechanics or artisans, farmers or gardeners, will lay aside the absurd prejudices so long entertained against books and *book learning*. A constant *routine practice*, justified on the old plea, "This is the way we *always do it*," can never lead to, or admit of, judicious melioration in any thing. Scientific investigation, applied to existing modes of practice, and proved by careful and well conducted experiment, is necessary to the attainment of real improvement, and even to an advantageous use of the information actually possessed. A spirit of inquiry is necessary to every mechanic of the present day, who wishes to excel in his peculiar branch, and such aspirit your Magazine is, in my opinion, eminently calculated to foster and direct. No mechanic should be without it; every mechanic may possess it at its present price.

With best wishes for your success, I remain, your obliged and obedient servant,

H. F D.

New-York, June 5, 1834.

THE "*Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and A. B. CHARLES, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum *in advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor

MECHANICS' MAGAZINE,

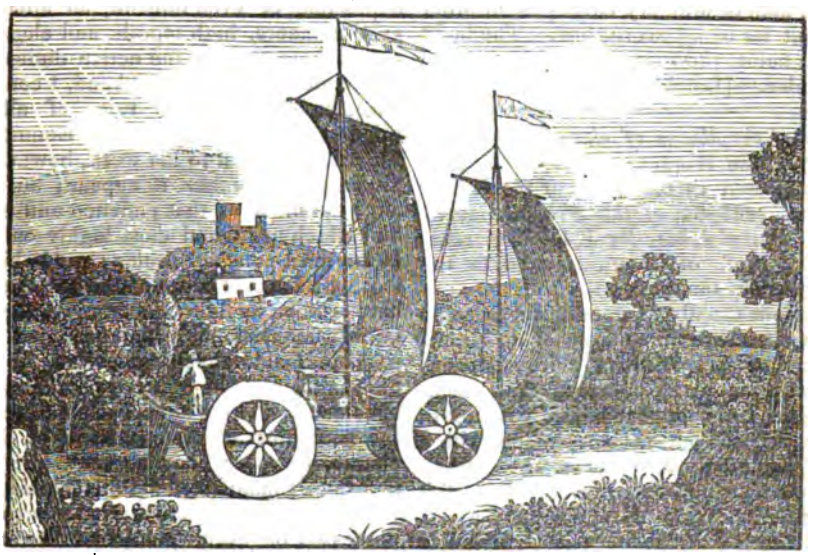
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING AUGUST 9, 1834. [NUMBER 2.

"We live in a world of wonders: things unsearchable and abundantly manifesting the existence of some power, whose range is far beyond our utmost comprehension. If we take but a single circumstance in the history of vegetable life, we find in it business for years, nay, for ages of toil and investigation."—SCIENTIFIC TRACTS.

STEPHINUS' SAILING CHARIOT.



THE SAILING CHARIOT.—It would be almost as difficult to assign limits to human ingenuity and invention, as to human ambition. That there are limits which the one cannot pass, while the other is boundless as the imagination itself, will not be denied; but the scientific discoveries of the last half century must make us hesitate before we say such or such a thing is impossible. In mechanics, in chemistry, and in the ingenious branches of the fine arts, improvements and discoveries have succeeded each other with a rapidity which outstretched all anticipation, and have set all calculations at defiance. No man will now dare say to any of these branches of science, "hitherto shalt thou go and no farther."

To be enabled to make the wind, which "bloweth where it listeth," subservient to the purpose of propelling huge vessels on the ocean, and thus to form an intercourse with the most distant parts of the world, was a great triumph of science; but to be able to steer a vessel with a rapidity that the wind does not generally afford, in a dead calm, or independent, or even against the wind, by steam, is a discovery which would not have been credited a century ago; and other discoveries which were once thought equally improbable have since been made.

The wind, which has been of such good service on the ocean, has for ages been used in machinery on shore, such as the working of mills, &c. Some individuals have, however, thought it might be used to propel vehicles on land. In the last century, Stephinus, of Scheveling, in Holland, constructed a chariot on wheels, to be impelled by the wind, the velocity of which was so great that it would carry eight or ten persons from Scheveling to Putten, a distance of forty-two English miles, in two hours.

Carriages of this kind are said to be frequent in China; and in any wide level country must be sometimes both pleasant and profitable. The great inconvenience attending the machine is, that it can only go in the direction the wind blows, and even not then,

unless it blows strong; so that after you have got some way on your journey, if the wind should fail or change, you must either proceed on foot or stand still.

The Hollanders have small vessels, somewhat of this description, which carry one or two persons on the ice, having a sledge at bottom instead of wheels; and being made in the form of a boat, if the ice break the passengers are secured from drowning.

Our engraving presents a perspective view of Stephinus' Sailing Chariot. The body of it is in the form of a boat; the axletrees are longer, and the wheels further asunder, than in ordinary carriages, in order to prevent its being overturned. The body is driven before the wind by the sails, guided by a rudder.—[London Mirror.]

On some of the Means of elevating the Character of the Working Classes. A Lecture delivered at the Close of the Winter Course, 1833–34, of the Franklin Institute of Philadelphia. By J. K. Mitchell, M. D., Prof. of Chem. Applied to the Arts. Frank. Inst.*

It is not usually in good taste, to come before a class with an apology for an imperfect state of preparation. Circumstances will justify me in so doing, in the present instance, as I now appear before you, not of my *own* accord, but in compliance with a request made only a few days ago. Sufficient time has not been given, even if it were *all* at my disposal, to compose a dissertation worthy of the occasion, much less could it be done in the few hours of release from the calls of a restless profession. Such as it is, however, I present it to you, with the confidence warranted by your invariable kindness to your teachers, that it will not be subjected to the rigorous rules of criticism, but that, even without any explanatory excuse, you would make all necessary allowance for defects, and dwell rather upon the goodness of the intention than upon the imperfections of the execution.

The subject which appears most suited to an occasion like the present, is the mechanic character—the causes of its actual and former condition—and the means of elevating it, so as to place the operative arts on the same platform with professional pursuits. If, in executing this task, I should probe harshly the wounds which I am preparing to heal, I trust that the love of truth, and the desire for improvement hitherto so strongly displayed by this class, will not desert it, at the very time when a full share of both will be necessary to the process of restoration. That I have a very sincere desire to improve and exalt the condition of the working classes, cannot *now*, I should suppose, be doubted by any of you. I have labored long enough, too, among the dust and smoke of a laboratory to feel myself entitled to the appellation of a workman; and while so engaged, have not been able to perceive any necessary connection between manual labor and degradation; any essential disjunction of the work of the hands from that of the head; any law of nature which should make impossible, or even difficult, an alliance of good manners, high morals, and elegant accomplishments, with the active duties of the mechanic. On the other hand, I constantly perceive the immense value of all these things to the workman. He cannot bring superfluous talent to his work, however simple habit may make it appear; he cannot have too much of that patience and self-denial which are found most highly cultivated in the most polished circles; and in his dealings with his customers on the one hand, and his workmen or fellow-laborers on the other, he will unquestionably find educated politeness, and habitual self-possession, the means of wealth, and the sources of affection and obedience. There is no one good quality of the gentleman which can sit ill on the mechanic, however poor he may be; this is abundantly manifested in Philadelphia, where many of the productive classes are found possessed of every gentleman-like accomplishment, and enriched and exalted by them in a way which ought to convince every one of their great importance, even in the promotion of the objects of business, and the accumulation of fortune.

In all simple and in artificial communities, persons skilled in any kind of workmanship were held in high estimation. Even among the celestials, the amusing mythology of the Greeks had placed a working divinity; and Vulcan, though soiled by his profession, and devoted to labor, was not the less a god on that account. Aaron, although the brother of the first of the prophets, seems, in the construction of the golden calf, and of the serpents, to have applied a remarkable degree of mechanical skill. The highly educated, eloquent, logical St. Paul, was trained to the business of a tent maker; and the *Saviour of the World*, who had been apparently carefully educated in the learning of the times, handled the axe and the saw. These, with examples nearer our own time, presented by Franklin, Fulton, Rittenhouse, and many others, show that, in the employ-

* Published at the request of the Committee on Instruction.

ment of the hands, there is no natural degradation, and that, whatever may be the artificial prejudices now prevalent on this subject, manual professions may be followed consistently with the possession of every noble and every literary qualification; and that the business duties of the mechanic are not to exempt him from the contribution of his share to the literary repute and worth of his country.

That this is not a common opinion is unfortunately true; that it is an unwarrantable opinion is unquestionably false. To show this in the stronger light, let us consider the causes of the present condition of the working classes, and we shall then be better able to indicate the remedies.

During the existence of the feudal system, the working classes were either the slaves or the essential dependents of the owners of the soil. Their vassalage necessarily degraded them. Laboring exclusively for the pleasure or interest of others, they looked upon employment as a task, the *conclusion* of which was alone agreeable, and which could not excite curiosity or bestow satisfaction. In any event, the reward of the toil, if it happened to pass into the hands of the artisan, was insecure, because laws were then made chiefly for the protection and convenience of those who enacted them; and *they* were seldom, if ever, men who could not boast of a long line of ennobled ancestry. A sense of constant dependence—a ceaseless feeling of insecurity—create servile habits, low cunning, and habitual deference towards the sources of power and protection.

Under the most favorable circumstances, the artisan became the resident of some town or city, which had procured from royal bounty, or interest, or policy, certain immunities. But even there the tenor of the times scarcely suffered him to escape from the thraldom incident to his occupation. Either the town was subject to the overshadowing power of some neighboring baron, to whom it paid fealty for the sake of peace or protection; or it was under the control of petty tyrants, the offspring of corporation acts or customs, who lorded it over their fellows with that arrogance and cruelty which we so often see exercised by those who have but recently acquired power and consequence.

Incapable of securing either wealth or station, it was scarcely to be expected that the working classes of that age would covet, or obtain, the advantages of mental cultivation; or that the education of themselves or their children would become an object of much importance. Even if desirable, education, as we now understand the term, was inaccessible to almost all of them. Learning, contradistinguished from science, was the fashion of the age; and, confined chiefly to the monasteries, it was hardly attainable, even by the nobility. But, such as it was, the learning of that period could have been of little use to the artisan in the pursuit or improvement of his profession. Inductive philosophy, the creature of the genius of Bacon, and the great light of the arts in our time, had not yet been born; and science might have sought in vain, amidst the false lustre of the school of subtleties, for one single ray of true practical knowledge. All the influences, therefore, of the times were adverse to the mechanic. There existed no consequence but that of the noble, or the monk; no security, but that of hereditary power; no accumulation, but that by the king or the baron; no education, but that which, inaccessible to the artisan, could not, if attainable, have elevated his intelligence, or illuminated his pursuits. It is not, therefore, so much a matter of surprise, that he sunk into ignorance and degradation, as that, in spite of such sinister influence, he should have been able to sustain so much respectability, and to contribute so much to the advancement of the manual arts.

A pursuit essentially dependent, affording no security for its gains, and unadorned with the lustre of education, is never adopted by any but such as are driven to it by necessity, or inured to it by habit. It is therefore followed, usually, by low and vulgar minds, and is consequently in danger of becoming still more degraded in their hands. It was so with the mechanic arts, and their cultivators, down to that period when a great variety of causes, political, moral, and religious, began to re-act on the monopolists of privilege and power, and brought the people into the possession of a share of both. Among the most influential of these causes was the growth of great towns. As a community becomes more extensive, individuals lose their prominency, and the public is more conspicuous. Units are merged in aggregates; and as the mechanic was lost from sight in the vast mass of human beings, he was left to the less fettered pursuit of his business and his happiness. He was more at ease, and, of course, more industrious. He was surer of his gains, and consequently more eager to embrace all the means of acquisition. He felt that education could be made a source of distinction, and, as it was now attainable, he sought it both for pleasure and profit. A common cause, a general inter-

est, often brought him, for the sake of gain, or the repulsion of invasion, civil and military, into concurrent action with the merchant, the lawyer, and the physician; men who had long before him broken through the barriers of exclusive privilege, and asserted *their* claims to a share of education and refinement. Such association could not fail farther to increase the nominal, as well as real, importance of the mechanic, and to add to his social value, as well as his intellectual culture.

Yet even under the most favorable position assumable in Europe, even now, the mechanic is exposed to the deteriorating agency of many artificial arrangements. Subjected to a long apprenticeship, he must begin his course of manual labor at least as early as thirteen, and is of course debarred from acquiring that kind of education which is to him of the most vital importance—a *philosophical* education. That is not attainable at so early an age. A very great many of the towns of the civilized part of the old world are incorporated so as to exclude, from the exercise of an art, those who have not inherited, or bought its "freedom," even though regularly indented, and legally authorised to practice it elsewhere. Besides, the artificial distinctions in the society of these countries are perpetuated as well by law as custom, and a tradesman there is scarcely yet tolerated in using the dress and the habits of what they call the better classes.

These numerous artificial causes have had the effect of creating a degraded estimate of the value of the mechanical professions, which has travelled across the Atlantic to us, and like many other of the feudal and aristocratical falsities of Europe, has been unfortunately ingrafted into the very substance of society in this country. It is for this reason that some callings are esteemed more genteel than others, which are as intrinsically noble and useful. You well know that the profession of the lawyer or the doctor, though properly speaking unproductive, is esteemed more honorable than that of the mason, the carpenter, or the blacksmith, which is continually promoting the wealth and the power of society.

Thus far, then, the mechanics are not censurable for holding, in the scale of society, a station inferior to that to which, by their wealth, numbers, political consequence, and public usefulness, they should be entitled. But it is not in accordance with the good sense, good feeling, and love of justice, so conspicuous in the American character, to continue the pressure of the odium of a *caste*, unless the people upon whom it weighs, by neglecting the means of escape from it themselves, become voluntary sufferers, and rivet the fetters thrown around them by ancient usage and imported prejudice. If, then, the American mechanic is not yet, however truly estimable, rated as he ought to be, the cause will be found, most probably, *in his own hands*.

If we carefully weigh the conditions essential to the honorable reputation of any profession, or class of individuals, they will be found chiefly in the degree of moral cultivation demanded either by usage or by business. For this reason the divine, the lawyer, and the physician, pursue avocations held in the highest respect in every country where they are really learned professions. In these employments the books to be consulted are numerous, and many of them in foreign or dead languages. To the due comprehension of these, a good preliminary education is indispensable. The gentlemen therefore of law, divinity, and medicine, are generally possessed of a considerable degree of classical learning, which, elevating their taste, and refining their sentiments, renders them both agreeable and instructive companions, and makes them welcome, as such, to the best society, of which they become an essential and important part. But to the successful cultivation of most, if not all, of the mechanic arts, a preliminary education, beyond the mere elements of the vernacular language, has unfortunately not been esteemed necessary; and hence, as a class, mechanics have not been noted for those companionable qualities, which, giving zest and grace to society, render their possessor a desirable acquisition. How seldom is a youth, destined for a handicraft business, found passing through the ordinary routine of a college course, or employed in the acquisition of the foreign languages, in which may be found written much which, as an artisan, it would import him to know. The loss thus sustained is of much greater importance than, on a superficial observation, may be made to appear. It is in the gentle breast of tractable childhood, that we must plant the seeds of the tender and delicate sentiments. It is then alone that the mind receives a graceful flexibility, and imbibes a taste for elegant pursuits, and refined sentiments. Our original nature is so rough, selfish, and cold, that it requires years of sentimental cultivation to tutor it into the smoothness, self-denial, and generous warmth, so essential to the harmony, the elegance, and the interest of social intercourse. This is almost instantly perceived by an uneducated man, when brought by the force of circumstances into the presence of those

who have enjoyed the invaluable blessing of a good education. If he is observant, he will be forcibly struck with the charms of good society, and will lament, as thousands have done, that the opportunity of acquiring such things is gone, gone for ever. Although there are men so constituted by nature as to need little polish from the study of the schools and the example of cultivated minds, they are not common; and the fine lines of Pope will be found generally true—

> "'Tis education forms the *common* mind,
> Just as the *twig is bent* the tree's inclined."

When we carefully examine this passage, we are struck with the exception implied by the word "common." Pope, who has written on the ruling passion, knew well, that men of peculiar moral conformation could not be formed by education, but used education for the promotion of favorite pursuits.

Examples of men rising superior to the obstacles of ignorance and poverty into a surprising degree of consequence, are however much more common than those of escape from the contamination of early bad manners, to agreeable ease, and acceptable social elegance. But even such instances, if more common, should not prevent a parent who designs his son for a mechanical pursuit, from giving him, if practicable, a good classical education. Such a course would appear singular at first, but, if generally followed, would cease to attract notice; and the favorable difference in the social consequence of a highly educated mechanic would attract a crowd of imitators; and after no very protracted period, the artificial barrier now left standing between various classes of society would be broken down, and the last relics of our feudal origin and transatlantic prejudices would be extinguished. That, however, must be done by the mechanics themselves. They must cultivate the means of advancement, to be advanced; and cannot rationally complain, if, having deprived their sons of the ordinary accomplishments of good society, they should be kept out of it by a sense of their own inferiority, or the good taste of those who compose it.

It may be said that a mechanic has not *time* for the pursuit of classical and elegant literature, and that, if possessed, it could not promote the interests of his business. There *is* time. If a boy, whose mind has been disciplined by education and whose intellect has been sharpened by exercise in the schools, be finally sent to the study of a trade, he will not only learn it in a shorter time, but he will learn it better, less mechanically, and more intellectually. It will scarcely be denied that as much time is necessary to learn the science of medicine as to acquire a knowledge of any other art whatever; yet we perceive that in three or four years, a clever student of physic possesses himself of an amount of science which would appear incredible to one unused to the acquisitive power of early training, and habitual mental exertion. The preliminary moral *gymnasium* of his classical schools gives such force, flexibility, and retentiveness to his faculties, as to enable him to do in three or four years what, without such preparation, he could not, even if at all possible, accomplish in twice as many.

If such an education were usual with mechanics, it would afford them a new and elegant recreation, without diminishing their zeal for their art. And as their art would, by such means, become itself more respectable, they would not feel themselves degraded in its pursuit. In a solitary road of upper Virginia I was attracted by the appearance of a Yankee pedlar, who, with great enthusiasm, recited verses from a copy of Virgil, descriptive of a scene similar to a very striking one then before him. I naturally inquired into the history of such an individual so engaged. He informed me that his father had given him a good classical and philosophical education, and had brought him up to the business of a tin-smith. At this trade he had worked assiduously for many years, during which he had beguiled his hours of leisure by classical reading. "Virgil, sir," said he, "is my favorite author, and I never go on a journey without him. He is good company. He shortens the way, enlivens an evening, or a rainy day at a tavern, and enables me to bear better the usual adversities of my diversified life. I make my tins myself, harness my horse, load my waggon, and journey now and then to the south to sell them." Here you see that a classical scholar, a man of taste, in fact a cultivated philosopher, was not ashamed to pursue a very common mechanical business, and he did it with skill and attention. It was the custom of his home, familiar to him, and it elevated not only the individual, but the business. *Time* too had been found, not only by him, but by many others in his neighborhood, to educate themselves classically before they entered on a trade. It does not appear that their time was lost, even with reference to their business, since they were quite as skilful in it as those who went to it early, and brought less sharpened understandings to the work.

Even if *money* were the *sole* object of life, the chance of its attainment would not

be lessened by a good preliminary education. But money can be valued properly only as the means of obtaining rational enjoyment. If, then, in a refined education are found new sources of pleasure, new powers of promoting happiness, and respectability, we have one of the best things that money can buy—a good, too, not as easily lost as money, and which, after our youth has gone by, cannot be purchased by the wealth of the world. Bodily activity is so natural to youth, that all young animals are, when awake, in constant motion. It is almost impossible for one of riper years to follow a child through the evolutions of a single day. The little fellow, obedient to impulse, exerts every muscle, stimulates every nerve, trains every member, and every sense, for future use, and happily seldom requires either solicitation or instruction, to prepare himself *physically* for his part in the drama of life. Nor does nature forget to train, at the same time, his moral powers. The acquisition of knowledge made by the time a child reaches the end of its third year is stupendous. But while the muscular education goes on as rapidly as ever, the moral exertion begins from that period to decline, and a less stimulated curiosity exerts over the mental faculties a less active control; and unless a systematic education be substituted for the waning discipline of nature, the mind becomes listless and less enterprising, loses its habitual acuteness, and presents to the observer the man of nature, such as our aboriginal people, active, strong, cunning, incurious, ready for war, for hunting, or the dance, but averse to moral labor, and insusceptible of all the softer and more elevated enjoyments of life.

The want of that cultivation which, by exciting his more tender and graceful sentiments, best fits a man for the society of females, while it steals from him the sweetest and purest enjoyments, deprives those who have a right to expect better things at his hands, of all that delightful intercourse which classical taste and literary refinement can alone produce. Sensible of this, coarse and vulgar men are seldom found, at nightfall, within the precincts of home. Incapable of entering into the feelings, or of participating in the gentle pleasures of domestic life, they are found congregated together in lodges, at taverns, at shows, or theatres, or in any place where they may find refuge from vacuity in strong excitement. Their women are left to themselves; and all of a father which his child can know, is as an eating animal at meal times, and an absentee at night. Such is the result of a want of refined education in any class, or in almost any individual; and if large and very important sections of society voluntarily abstain from such improvement of themselves and their children, although they may occasionally present, as I *know* they do, many very honorable examples to the contrary, yet, as a class, they must suffer loss, both in the means of happiness and the estimation of society.

The neglect of classical education, among those to whom it was formerly deemed an indispensable accomplishment, is among the most alarming signs of a decay in one of the most interesting departments of American civilization. By degrees, merchants and others, engaged in pursuits not immediately dependant on classical learning, have imbibed the opinion, that an acquaintance with elegant literature disqualifies a man for business, and that few of those who have a classical taste or predilection succeed in the active duties of life. It is true, that when a man gives *superior* attention to his amusements of any kind, and postpones his occupation and his interest for his pleasures, he will fall short of success. A theatre—a grog shop—a club—may also trench too much on a man's time and attention, and work his ruin more effectually than Milton or Homer, and that too without leaving him those bright fragments of enjoyment, which, amidst broken fortunes, remain for him who has preserved his innocency and his taste. The objections to learning, like the objections to all that is good in itself, are necessarily derived solely from its abuse, and ought not to militate against its use. In Europe, many of the merchants, whose financial skill has filled the world with their renown, are men of high finish and elegant accomplishments; and in Boston, it is a very common thing to find the student of Greek and Latin classics in the compting-house, there distinguished for the skilfulness of his speculations, and the wealth acquired by his wisdom. With us, unfortunately, the opinion of its hurtfulness leaves us but few opportunities to judge of its value, and unless we soon divest ourselves of this absurd prejudice, we shall not be able to find at home the seminaries in which it will be possible to recover our lost ground. Already they present strong symptoms of decay, and in a few years, unless the working classes will in this, as they do now in many other things, set a noble example to those who have voluntarily divested themselves of the only rational ground of distinction, our colleges and classical schools must entirely disappear. In the city of Philadelphia, there are probably not less than

thirty thousand families. If in each of one third of these families, there exists one young man of a fit age for college, we have at least from five to ten thousand young men qualified by age, at least, to be in the course of education in such an institution. But will it not surprise you when I say, that Philadelphia does not send to all the colleges of the Union a number of young men sufficient, if collected together, to well support one single institution. Since I have been familiar with this subject, there have not been more than one hundred and fifty youths of Philadelphia, at one time, at all the colleges of the Union. Nor has this arisen from a deficiency of skill in the professors, either here or elsewhere. At this moment our own University is rich in the means of instruction, and at a rate which would not tax severely the purse of the poorest master-mechanic; and I *do* trust that, in a very few years, the institution in whose Hall I now address you, will present still cheaper access to elegant, as it now does to scientific education.

Amidst so many things to admire in us and our institutions, even the most friendly foreigner observes with regret our deficiency in elegant literature, and the consequent infrequency of writers of taste. We are free, well informed, industrious, affluent, ingenious; but we are grave, deficient in enthusiasm, and almost wanting in the higher graces of conversation and literature, to which society owes, elsewhere, its greatest charm, and without which we lose much of the sweetest enjoyments of life. Much as I love my home, greatly as on the whole I prefer this, my native land, to every other, and I have seen them nearly all, still, knowing as I do the great enjoyment to be found in that society where the mind of almost every one is refined by acquaintance with the polite writers of every age and country, I cannot resist the feeling of regret at the loss we voluntarily incur, nor can I refrain from expressing the hope, that the time is not far distant, when high refinement and manual labor will not be found incompatible, and when *our mechanics* will be entitled, *in the very best sense of the word*, to the name of *gentlemen*. Coarseness and vulgarity are disgusting, even to the vulgar, for there is no man, however gross himself, who does not feel pleased at the improved manners and literary attainments of his son; just as there scarcely ever existed a drunkard who did not love to see his child averse to the destructive vice to which he had himself become the victim.

Highly as we may estimate classical education, as a means for the advancement of the happiness, the worth, and the companionableness of the mechanic, there is another department of learning still more essential to his professional interests. Science, as contradistinguished from learning, enters into every, even the humblest and simplest mechanical occupation. Not to mention those trades in which it is obviously applicable, such as instrument making, clock making, machine making, &c., men engaged in leather dressing, dyeing, tanning, fulling, &c. are constantly employing scientific processes, and do this better, or worse, with more or less prospect of inventive or judicious results, according to the greater or less familiarity with their principles.

That mechanics have not closely studied philosophy is attributable chiefly to the thraldom of prejudice, and the disabilities which, created in feudal times, are not yet removed, even in our own age and country. In other countries, and at a more remote period, philosophy was the privilege of but a few, to whom hereditary wealth, or professional necessity, brought the boon. *Experimental* philosophy, at least, was taught in but a few expensive seats of learning, to which scarcely any one but a member of the hereditary aristocracy could find access on any terms. It was then impossible for a boy, devoted by his pursuits to any manual occupation, to obtain admittance to such places of instruction, and, if possible, the enormous expense operated as a preventive; for if that could be afforded, the then profits of the anticipated trade would have rendered it inexpedient. That which was, in former ages, a necessary ignorance, became, as it were, a badge of degradation, and illiteracy and labor were so commonly united as to be esteemed inseparable.

So hurtful is this evil, in the eyes of some of the greatest men now alive, that they have almost devoted themselves to the duty of enlightening and reforming a class essentially the most important to the interests and welfare of society. Lord Brougham, Dr. Birkbeck, &c. are now laboring hard to make knowledge cheap and accessible, and to persuade the artificers of all kinds to throw off the shackles of the worst description of tyranny, that of professional ignorance and apathy. In this they have succeeded to a very remarkable degree, and while we are boasting of the revolution which gave us the mastery of ourselves, we are submitting, even yet, to the most degrading influence of the mechanical and aristocratic institutions of the country from which we were delivered, and, I fear, permitting the people from whom we separated to outstrip us in that kind of

knowledge which is the true source of individual advancement and national prosperity.

Within a very few years, however, a new spirit begins to pervade the laboring classes of our city, and at length, desirous of advancing to the station long since accorded to them by our national institutions, they seem resolved to prepare themselves for their professions in the same philosophic manner as the divine, the lawyer, or the physician. This is as it should be; for otherwise, it would appear singular to boast of our national independence in language which, itself expressive of ignorance, betrays the lamentable dependence on foreign influences of the basest and most dishonorable character. The time has at length I hope come, when *profession* will be no longer a plea for *ignorance*, or *trade* an excuse for *coarseness* and *rudeness*. Henceforth, a mechanic, ignorant of the principles on which his art is founded, will scarcely be better tolerated than would a physician who should dare to practice his art, when convicted of ignorance of the philosophy of the circulation of the blood. While debarred the schools of science, by the exclusiveness of the aristocrat, or the high price of learning, he might be pardoned for an unavoidable ignorance; but now, when science opens her arms to receive him, and beckons him to her temple, he must enter her honorable courts, or blame himself alone for his exclusion. And if despised by those who have embraced the rejected opportunities, he finds himself lowered on the scale of society, let him remember that, in our country at least, it is impossible to support long any other distinctions than those of talent and learning, and that *he* will be considered most noble who is so indeed, and *he* most agreeable and most welcome, who, by great cultivation, has possessed himself of the affluence of the powers of pleasing. The revolution begun in '76 will not be completed until the artificial barriers of society, instituted in Europe, have been entirely overthrown; and that can be done solely through that cultivation which will render them unnecessary. In Europe, a vulgar and ignorant man may be found among an hereditary aristocracy, and be sustained by the privileges of his class; but here, such distinctions have happily vanished, and such a man will, whatever his wealth or his profession, sink into merited contempt.

I feel greatly encouraged by the zealous and untiring pursuit of knowledge evinced in the class I am now addressing. Every night, regardless of the inclemency of the weather, you have filled this spacious hall to its very walls, and have expressed no impatience at demonstrations necessarily prolonged, and often deficient in direct interest. All this augurs well for the future, and promises us a harvest, of which the good seed will be again sown for future increase. Let the mechanics of one generation be, as they should be, philosophically educated, and, in America at least, such an education will become forever indispensable. You have, therefore, a double incentive to exertion. Your own respectability and interest, and the elevation of the character and pursuits of your successors for all future time, seem to be now in your hands, and, in improving yourselves, you will benefit and exalt your country.

If the magnificent bequest of the late Mr. Girard should be applied as it ought to be, I think the mechanics will receive an impulse from an unexpected quarter. It is now almost certain that the orphan children who are to enter the Girard College will be carefully educated in classical learning, and fundamental philosophy, and will most of them afterwards engage in operative pursuits. They will soon form a numerous body of mechanics of the very best quality, and render an equally good education imperative to others; for be assured, as you may be by the many fine examples already among yourselves, that exactly in proportion to the intelligence and skill of the workman will be his success in business. The doctor may practice unworthily, yet extensively, his hidden art; the merchant may, by good fortune, succeed without education in his adventures abroad and his speculations at home; but the mechanic must, in his less eventful occupation, depend for success on his merit and his skill, and these will be proportionate to his natural and his *cultivated* faculties. His defects, if they exist, cannot be concealed, and his good qualities must be apparent in his productions. These always speak an intelligible language, and are generally of a very obvious character.

Every thing around us which relates to the advancement of the operative arts is of an auspicious character. That is, indeed, amidst the existing tendency to the decline of literature amongst us, a subject of unfeigned exultation, because it is not possible that a general scientific movement on the part of the mechanics should be unaccompanied by an improvement in the education of every other class of society. That part of society which has unfortunately been permitted to monopolize the classical distinctions will not tamely see you transcend them in science, but, entering on a very honorable and profitable competition, brighten themselves

and stimulate you. This is the only warfare which should be conducted by various classes of society among us, and its end should be the triumphant success of all.

It is vain for one section of society, in our country at least, to envy another its superiority or its influence. These follow knowledge and manners as naturally as the brightening of the face of the landscape does the rising of the morning sun of spring. By numbers, a set of educated men may be divested of power, or consequence, but it will only be to put another set of the very same kind in their places, and those who have made the change, if themselves uneducated, will not be benefitted by the alteration. While society maintains the forms of orderly government, such is the case in all free communities. Monarchies and oligarchies present occasional exceptions, and sometimes during the reign of civil commotion, spirits, from the vasty depths of ignorance, rise, through extraordinary force of character, to ephemereal exaltation. Sooner or later, however, the natural tide of events flows on, and those best qualified to guide the councils, and direct the destinies of society, will be found at the helm, though the spontaneous choice, too, of those who have not prepared *themselves* for the station. To obtain a share of power, to become eligible companions, welcome associates, to raise the credit of the class, and wipe off from it the involuntary stains brought from feudal times, and foreign countries, and to remove the badges of mental degradation, voluntarily assumed even here, the mechanics must not waste the time in unavailing regrets, and useless jealousies, but, buckling on the armor of learning, and seizing the sword of science, advance to the combat for an equal station, with that ardor which must conquer, and that knowledge which will make the victory honorable to themselves and glorious to the country—the whole country—and I was going to say, nothing but the country. But, no! no! that will be a victory auspicious to the *world*. So grand a spectacle is seldom seen in the universe. A whole community of mechanics, refined by literature, polished by good society, illuminated by philosophy, enjoying *all* the pleasures and honors of education, and carrying the arts irresistibly forward, to a degree of excellence of which the present age, with all its hurrying progression, sees but the beginning. That cause, once well begun, can have no limits but those of the world,—no overthrow but that which must come to all things, when "*Time* shall be no longer."

So truly honorable a result will throw back great reflective credit on the institutions in which originated the efforts for melioration: and among such institutions, none will probably, in our country, hold a higher rank than the *Franklin Institute of Pennsylvania*. It is but a very few years since a small number of individuals, most of them yet young, conceived the idea of affording, at a cheap rate, the sciences to the working classes, and all others who might be unable to apply to more expensive places of learning. With almost incredible zeal did they collect the funds, and erect, on a lot purchased in a central situation, the noble edifice in which I have now the honor of addressing you. A Board of Managers was elected, a Committee of Instruction appointed, and the best teachers sought for and found. Many of you must remember the zeal and skill with which Doctor Thomas P. Jones conducted the course of experimental philosophy, and practical mechanics; and with how much admirable science Professor Keating combined the power of throwing charms around the processes and the theories of chemistry. Professor Franklin Bache,* who followed him, is yet agreeably remembered for his profound knowledge, exact method, and exemplary precision; for the efforts which he made to call your attention from the striking experiment to its connection with, and illustration of, the great principles of the science. Of the deep research and instructive course of my present fellow-laborer, Professor Johnson†, I could say much which would meet with a ready response from a class which has acquired the title to estimate their merits, and unquestionably is inclined to fully appreciate their great desert. At the call of the government, Mr. Franklin Peale‡ has gone abroad to examine and report on the processes pursued in the mints of other countries, and for the past season we have been deprived of his ingenious, amusing, and instructive lectures. But Doctor Emerson§ and Mr. Millington‖ have filled up his evening by discourses at once improving to you and most creditable to themselves.

It is not alone, however, to the lecture-room, that the merit of the Franklin Institute is confined. Through the aid of the committee on publications, and the variety and

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* Now Professor of Chem. and Pharm. in the College of Pharm.

† Professor of Nat. Philos.

‡ Lectures on Practical Mechanics.

§ On Meteorology.

‖ On Astronomy.

extent of his own accomplishments, Dr. Jones is enabled to conduct, in the name of the institution, a journal remarkably well calculated for the promotion of knowledge among mechanics, and the furtherance of the scientific reputation of the country. That journal is not only read with advantage at home, but is often, in the most flattering manner, quoted by the best scientific journals abroad. It has continued, for several years, an unwearied flight, and, as yet, has moulted no feather of its well-earned reputation. I need not fear reasonable contradiction when I say that no similar institution has sustained so long, and so well, an equal magazine.

In addition to these claims to public estimation, the Franklin Institute has conducted, and is now conducting, toilsome and very expensive experiments on some of the most important questions in practical science. With much labor, and great expense, experiments have been made on most of the requisites of water wheels and adjutages, so as to finally settle a point of great importance to every one who employs water power in the movement of machinery of any kind. The unfinished report of the committee on this subject is a master-piece of its kind.

The investigation of, and report on, weights and measures, made by the request of the House of Representitives of the State of Pennsylvania, adds a new claim, on the part of the institution, to public approbation, while the committee on steam explosions will soon put in another, of no inconsiderable weight, for an indefatigable, hazardous, and expensive series of experiments, under the patronage of the government of the United States, most ingeniously diversified. A very great deal of the labor and skill applied to these investigations has been bestowed by private members of the Institute, unpaid, and without any other motive than that of doing good to society.

I have made this exposition of the doings of the Franklin Institute, not for the vanity of the display, but for the sake of justice, and example. Our own citizens, perhaps even the members of the Institute, have not been fully aware of the extent, variety, and importance of its public services, nor acquainted with the honorabe nature of its claim to the support and countenance of our community.

It might be supposed that I had now stated all the merits of the institution; but when I look to the left, and see before me a large proportion of females, attentively engaged in receiving instruction, I cannot refrain from exulting in the prospect of great gain from their example, as well as their improvement. It has been said, and I believe most justly, that the character of the child is formed or deformed by the example and instruction of the mother. She is entrusted with the discipline of thought, at that critical period of life, when, through the flexibility of the mind, a bent is easily given to character, and the young ideas just begin to shoot. It is her care to protect the tender blossoms of thought and feeling, to prune rank luxuriancy, encourage honorable sentiment, and kindle the love of labor, and the taste for learning. She should not be found often unable to satisfy the curiosity of her child; nor should his eager thirst after knowledge be destroyed by the oft-repeated declaration of impatient ignorance. How many Newtons have been withered in the bud—how many Franklins consigned to obscurity by the presence and the influence of a mother, who, herself totally ignorant of the value of knowledge, feels no disposition to encourage in her child the love of science, or a taste for the arts!—Oh! if a mother, in *feeling*, ought she not to long to brighten in the bosom of her child, a taste, which, while it will afford him many an hour of delightful recreation, and open to him an agreeable path to honorable distinction and public usefulness, will also shield him from the thousand snares of vice set for the idle, the ignorant, and the obscure. But, more! many, very many of those who now hear me, pursue the creditable and useful profession of *teaching*, and are, like the honey-bee on his flowery embassy, abstracting the sweets of learning, to carry them home to a busy and eager school, to be again scattered far and wide for the benefit of society. This is the compound interest of learning—the field which produces a thousand fold.

Let Philadelphia, justly proud of this institution, so munificent of good, continue to carefully foster it; and let the mechanics, to whom it more especially belongs, forget not, that it is the first great step of their advancement to their proper station in society, and cherish it as at once most useful to them, and most creditable to their character.

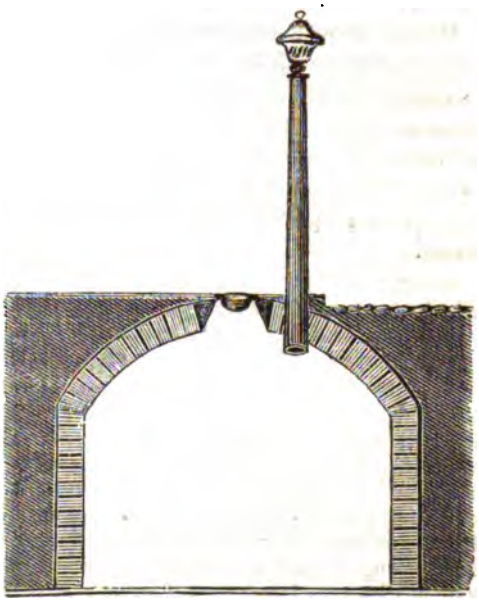
If we should, by the permission of a kind Providence, again meet in this place, you will find me prepared to extend and improve the system of instruction in my department. I have caused to be made models of buildings, and implements used in the arts, which, for want of time, I could not exhibit during the present session. In the next course, I shall be able to present to you the interior of the glass-house, the pottery, and the iron-furnace, displayed in sectional

models, in which will be made readily comprehensible the various processes by which glass, china-ware, and iron, are produced. I have no doubt that my able colleague will make at least equal exertion to improve and extend *his* course, and that the next season will greatly exceed the last, in the value and variety of its instruction.

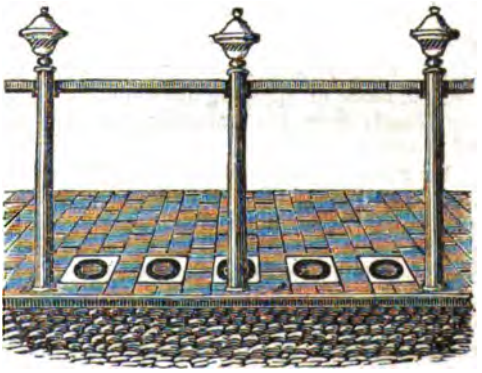
The least agreeable part of my task remains. I am now to take a final leave of you for the season. In doing so, let me not forget to thank you for the polite and quiet attention paid to my feeble endeavors to please and instruct you; for the patience with which you have borne disquisitions necessarily tedious, the respectful silence during the hour of lecture, and the avoidance, at its close, of any noisy demonstration of a satisfaction, not unknown to your teacher, but conveyed in a manner worthy of the place, of yourselves, and of the cause of science. These things console me for the toil, expense, and inconvenience, of a course, which, under the pressure of heavy professional engagements, has not been conducted in such a manner as either to benefit my purse or economise my exertion. Yet, thanks to you, I feel amply compensated for these sacrifices, by the persuasion that society is benefitted, and that you are kind enough to be satisfied with my exertions.

And now, permit me to wish you a prosperous summer, useful, agreeable, and profitable pursuits, and a return to the course of the next season, more highly prepared to receive instruction yourselves and to convey it successfully to others.

ROCKWELL'S PATENT VAULT LIGHT.—Every citizen is aware that the common vault light, or grating, which may be seen on our sidewalks at every few steps, are not only unsightly to the eye, but often positively dangerous. Very frequently they are found loose, often broken, with a bar or two out, and in winter so slippery as to render it hazardous to step upon them. Independent of these considerations, by their openness to permit rain, snow, and dirt, to pass into the vault, and render them wet, cold, and filthy, the advantages of Rockwell's Patent Light are many. There is nothing unsightly in their appearance; but, on the contrary, they are ornamental,—are made to set secure in stone, and immoveable, except when it is necessary to remove them. The passenger may put his foot on them with perfect security; and whilst they keep the vault dry, and permit ventilation to go on, possess, in addition, this advantage: they furnish, by means of the glass in the centre, light to enter, and from its convex shape, to radiate on all sides, thus giving light to the vault. Fig. 1 shows the vault, and the pipe through



which air is admitted. This pipe can be stopped up in winter if necessary, or converted into a chimney. Fig. 2 is intended



to represent the appearance outside, covering a space of 25 feet in the street.

Mr. Rockwell, the inventor, has also made these vault lights without ventilation holes, which are admirably adapted for vegetable vaults, where light only is required, thus excluding all cold and wet, but serving as win-

dows to light these hitherto dark apartments.

The durability of this light, compared with the common vault covering, will be found to bear no comparison with the difference in price, which is little more than the most common in use, independent of its superior qualities.

Persons about to build, or those who would wish to improve their vaults, may see this simple, yet beautiful and economical improvement, in front of the Exchange, where two of them have been placed over vaults,—in front of the New-York Gazette,—or at the store of the proprietor, Broadway, near John street.

Newly Invented Apparatus for Raising Vessels for the Purpose of Repair. By Rufus Porter. To the Editor of the Mechanics' Magazine.

Sir,—Having recently invented several improvements in machinery, &c. some of which are in successful operation, and being at present engaged in constructing others, and having heretofore, in several instances, been anticipated (honestly enough, however,) in applying for patents for improvements of which I had supposed myself to be the original inventor, I would give notice to the public, through the medium of your valuable Magazine, of certain inventions, supposed to be new, and of my intention to apply for patents for the same as soon as I may be able to test their utility, and ascertain what points I may safely claim as original. I shall commence with a description of an apparatus, and the mode of applying the same, for raising vessels from the water for the purpose of repair, as follows:

Four large square timbers, eighty feet in length, are placed parallel to each other, and so arranged that the space between each pair is ten feet, and the whole breadth across the four is forty feet. Across these are placed, at equal distances, seventeen other timbers, forty feet long, being firmly secured to the first four by trunnels, and over these last is laid a strong plank floor, the whole constituting a stage or platform eighty feet in length and forty in breadth. This platform rests on four square trunks, each being thirty feet long, ten feet wide, and ten feet deep. These trunks are constructed of framed timbers and planks, are closed and made tight on all sides, except an open space of ten feet in length by four in breadth, in the centre of the bottom of each; and are placed under the four corners of the platform, and between the long timbers above-mentioned, so that only the cross timbers rest on the tops of the trunks. The platform is further supported by braces extending diagonally from the sides of the trunks near the bottoms, to the middle of the cross timbers. The bottoms of the trunks are also connected by iron rods, crossing from one to another. The platform and trunks, (which, thus connected, I call an "Elevator,") being put into the water, (or rather, having been constructed afloat,) a sufficient quantity of stone is placed on the iron rods to cause the whole to sink, when filled with water. Two scows, each eighty feet long and eight feet wide, are kept in attendance, one of which floats over each side of the elevator; and ropes being attached to the four corners of the elevator, are also made fast to the bows and sterns of the two scows, thus preventing the elevator from sinking below a certain depth, say twelve feet below the surface of the water. Each scow contains, besides a small steam engine of one horse power, two hollow cylinders, similar to the cylindric boilers of high pressure engines; each cylinder being thirty feet long, and thirty inches in diameter. From each of the four cylinders, a piece of leather hose extends to one of the four trunks, being firmly attached to each. These cylinders being charged by the power of the steam engines, with fifteen atmospheres of compressed air, the vessel to be raised is floated between the scows, or if the vessel lays at anchor, the scows may be propelled by the steam power to a station on each side of the vessel, dragging the elevator with them, which is then raised by the ropes till the middle of the floor comes in contact with the keel of the vessel, and is secured in that position by several ropes or chains, which, being attached to the sides of the elevator, are made fast to the timber heads of the vessel; moreover, several chucks or blocks, previously prepared, and connected with the elevator, are placed under the bottom of the vessel, to support the same in its position when raised. Then, by means of valves, the compressed air in the cylinders is permitted to escape through the hose to the interior of the trunks, which immediately gives them a buoyancy of seven hundred thousand pounds. But if the vessel thus raised is of such a size as may not require so much power of buoyancy, the compressed air may be instantly shut off whenever the floor of the elevator shall have risen fairly above the surface of the water. While one ves-

sel is being repaired, the cylinders are again charged; and when the repairs of one are completed, other valves are opened, which permit the air to escape from the trunks, while the vessel settles readily but gently into the water, and the elevator is ready to receive another, thus avoiding the ordinary delay attendant on raising vessels by other means.

The expense of an elevator of the dimensions above specified is estimated at one thousand dollars, exclusive of the scows, cylinders, and machinery.

Yours, very respectfully,

RUFUS PORTER.

Billerica, Mass., July 30, 1834.

CHINESE IGNORANCE.—A literary Chinese, to become tolerably learned, must devote half his life to the acquisition of the words in his own language, which accounts for the general ignorance of the nation. The very costly and curious brass models of all the mechanical powers, which the French government presented to the imperial court of Pekin, were considered by the stupid, conceited great mandarins of state, as toys sent by the barbarians to amuse the emperor's grandchildren! Sir Geo. Staunton declared that the very expensive mathematical instruments manufactured by Ramsden and Dollond, conveyed to China by Lord Macartney, were as utterly useless to the Chinese as a steam engine to an Esquimaux, or a loom to a Hottentot.

INGENUITY OF THE WASP.—The following interesting paper was received, a few days since, from a gentleman of this city, whose philosophical inquiries entitle him to the respect of all minute naturalists.

While standing at my door this afternoon, my attention was attracted by a black wasp upon the back of a grasshopper, travelling at a moderate pace. The singularity of the scene induced me to examine them a little more minutely, and to endeavor to ascertain the object which the wasp had in this, to me, very singular ride. The grasshopper was of large size, the wasp's legs being barely able to reach the ground, as he sat, or rather lay, astride his back, with the grasshopper's antennæ in his mouth, and, as it were, for a bridle. The hind legs of the grasshopper were the principal locomotive powers employed, assisted, however, by the legs of the wasp, and excited by his sting, which was vigorously employed, especially when any obstacle fell in their path, at which time the wings of the wasp were also set in motion. The distance travelled in this manner was about thirty feet, and the time employed about three quarters of an hour. The wasp then stopped, and dismounting, commenced running in various directions, four or five minutes, when he again stopped, and, after removing some earth, entered a hole which had been previously excavated in the earth, and eagerly set about enlarging it, bringing out, at each time he entered, with his fore-legs and head, pieces about one-third the size of his body, stopping only to remove the earth as it accumulated at the entrance. After having been engaged in this manner for a little time, he returned to the grasshopper, (about three feet distance,) pursuing a circuitous route as before. Previous to this, the grasshopper not moving, I took him in my hand and examined him, but could discover no signs of life. My curiosity was consequently much excited, to know what means the wasp would take to get him to the tenement which evidently was being prepared for his reception. I was much surprised, therefore, when I saw the wasp remount, and ride on towards the hole, the legs of the grasshopper still assisting as before. Upon his arrival there, the wasp dismounted, and having several times walked over the grasshopper, commenced again enlarging the hole. This was several times repeated, probably for the purpose of ascertaining the necessary dimensions of his receptacle, which having been completed, he remounted, and rode to the entrance, dispensing, however, at this time, with the legs of the grasshopper, probably on account of the shortness of the distance, it being only five or six inches. He next entered the hole, leaving the grasshopper at the mouth of it, and, after turning, seized upon his antennæ, and dragged him in after him, which being done, he closed the entrance with earth—not with the same which he had before removed, but with a portion near by, perhaps at the same time commencing a similar excavation, for a similar purpose. The covering being completed, he flew away, having been on his legs for near an hour and a half, commencing from the time when I first observed him.

Perhaps the most singular part of this adventure is, that the grasshopper should remain still, after the wasp had left him. I can only account for it by supposing him to have been nearly dead, and only capable of moving his legs under the influence of uncommon excitement. This, as I said before, was furnished by the sting of the wasp. It is also singular that the wasp should take a circuitous course, when proceeding to and from the hole. This I supposed, at first, to

be done to prevent his footsteps being followed by other insects, and his deposit discovered, but this does not appear to have been the object, for when going with his prey his course was direct. I had forgotten to mention that he did not immediately fly, after having completed his work, but first ran about in every direction, for a considerable time, apparently for no purpose.—[Scientific Tracts.]

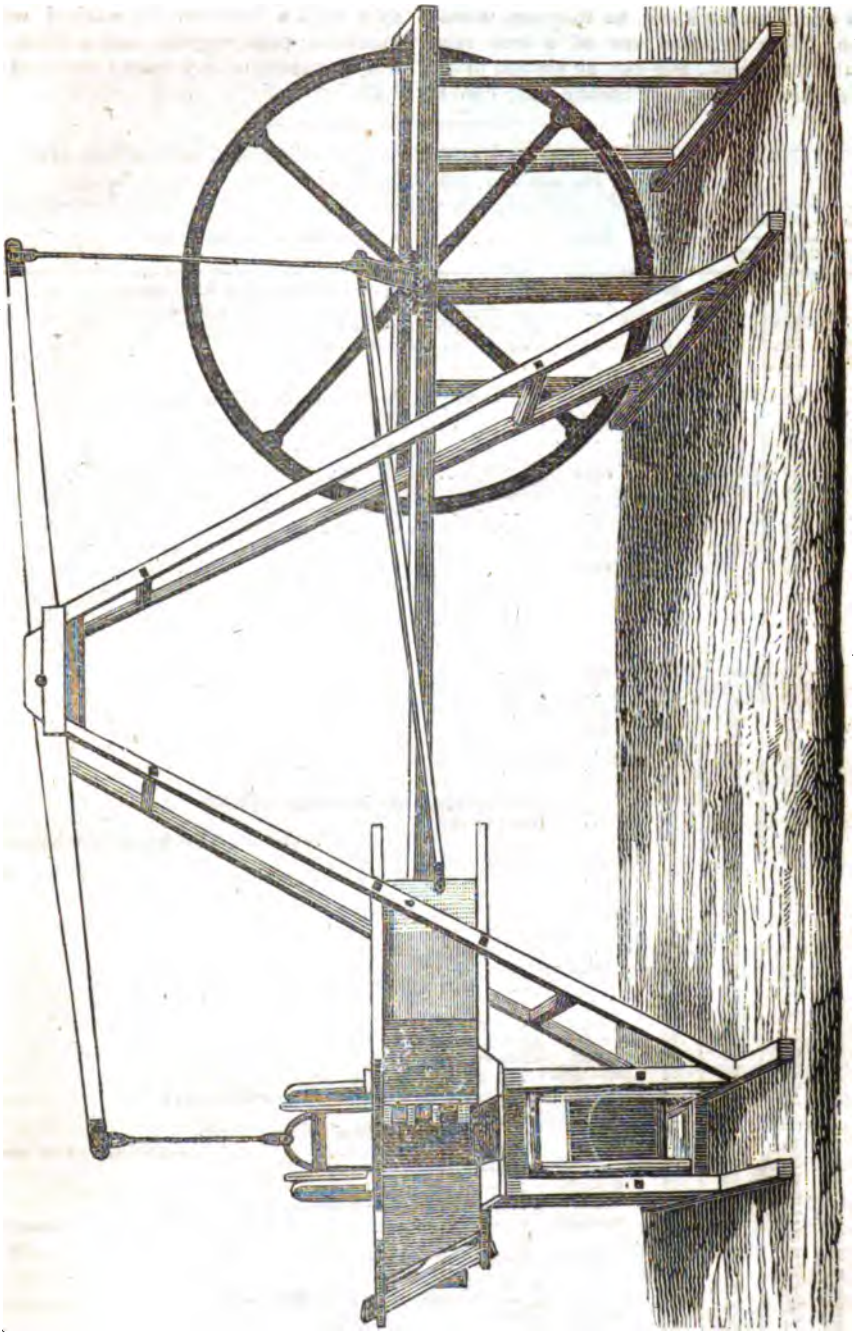
Lectures on Phrenology. Delivered before the Young Men's Association for Mutual Improvement, of the City of Albany. By Amos Dean. Oliver Steele, and Hoffman & White, 1834. 12mo. pp. 252.

Another book on Phrenology. "Will the line stretch out to the crack of doom?" Are the crooks and crannies of our skull to be spied out, and a book made thereon, and our bumps not even let alone? We must e'en get a wig made of porcupine quills, like our brother editor of the Lowell Bulletin. Had Shakspeare been a phrenologist, Hamlet would not then have apostrophized the skulls, when the grave of Ophelia was being dug, by supposing them to have belonged to a politician, which the ass then o'er-reached, a courtier, a lord, and a lawyer, whose fine pate was full of fine dirt, and who, with all his quidits, quillets, cases, tenures, and causes, suffered the rude knave to knock him about the sconce with a dirty shovel, and not tell him of his action of battery; and whose vouchers would vouch him no more of his purchases than the length and breadth of a pair of indentures. But, instead, we should have had as full, true, and particular account of their virtues and vices, the number and varieties of their bumps, as are described of the bust of Homer: even our author, with all his classical attainments, states that it has the organ of ideality extraordinarily developed, when no trace of his bones or country has ever yet been discovered; and some have even doubted of his existence, or of the siege of Troy, particularly J. B. S. Merritt, in his able pamphlet on that subject, published some time since. Well might the sly wag of Blackwood's Magazine get up the humorous story of the Turnip, mistaken for the skull of Plato by the lecturer on Phrenology at Edinburgh. However, badinage apart: the book before us is ably written, and the language abounds in lofty flights of eloquence, such as would adorn and grace any subject, as well as tempt us to believe the wrong was right, like the language of Milton's Satan when tempting Eve; but the stern school of philosophy needs not its path to be strewed with flowers, however beautiful they may be. Truth, when unadorned, shines brightest and fairest by its own true light; the foreign aid of ornament tends but to conceal the defects and hide the beauties.

The author, in his preface, adverts to a difference between Dr. Spurzheim and Mr. Coombe, in the numbering of the organs. When men like these, (whose whole lives have been devoted to the subject,) differ, we begin to doubt their theory: a house divided against itself cannot stand; and we feel "There's something rotten in the state of Denmark."

We can never reconcile ourselves to their creed, and which is the false position of the fatalist, alike injurious to the Christian and the citizen—the subverter of all religion and law. Yet with its poison it carries an antidote, and causes a deeper research into human nature, by the study of the brain and the skull. Hence Sir Charles Bell's able experiments on the Nervous System, one of whose results is rather against the system of Phrenology. "That the first part of the fœtus' nervous system is the spinal marrow, the upper part of which is first enlarged, and then the brain succeeds, making the brain the secondary, and not the primary, as the phrenologists do." Again, there are only nine pair of nerves proceeding from the brain, whilst there are thirty-one from the spinal marrow. The brain may be cut away or removed, without affecting the power of voluntary motion or giving pain, thereby contradicting Shakspeare, "That when the brains were out the man would die." If, therefore, the brain can be removed from the skull, what becomes of the bumps? Does the skull remodel itself according to the quantum of brain removed? How is it that the half-reasoning elephant has so small a quantity of brain contained in so large a head? But if we proceed to questions, we shall ask, and tire with asking: each answer will provoke fresh questions, and the line, (as we stated in the beginning,) "would stretch out to the crack of doom;" and we will therefore end our critique by earnestly recommending a perusal of the work under review; it will give rise to much deep research by the scholar, and will repay every class of readers bythe beauty and eloquence of its style, and the philosophical manner in which the subject is treated, though the flowers are rather too thickly strewed. This will, however, be no fault in the eyes of the fairest part of the creation, who wish to learn the heady subject of the theory of bumps, whether belonging to lover or husband.

T.



Flagg's Shingle Machine, for riving and shaving Shingles at one Operation. [Communicated by the Inventor.]

The above plate represents the Shingle Machine invented and patented by DAVID FLAGG, Jr., of the city and county of New-York, which can be seen at 104 Beekman street. It is one of the greatest labor saving machines in this country; it performs its work to great perfection, and at a rate almost incredible to all who have not seen it. It is very simple in its construction, and not liable to get out of order. By this machine sixty shingles are made from the bolt or block in one minute, being one a second, and more perfect than can be made with a

frow and drawing knife, as they are usually made. The shingles are of a true taper from butt to point, and can be shaved to any given thickness. Any timber that can be split with a frow can be worked with this machine: pine, cypress, cedar, chesnut, oak, ash, hemlock, or any timber that will rive or split.

METEOROLOGICAL RECORD, KEPT AT AVOYLLE FERRY, RED RIVER, LOU.

For the months of May and June, 1834—(Lat. 31.10 N., Long. 91.59 W. nearly.)

Date. 1834.	*Thermometer.* Morn'g	Noon.	Night.	*Wind.*	*Weather, Remarks, &c.*
May 1	72	81	80	s	clear—thunder and rain, evening—Red River rising
" 2	70	72	68	..	.. —cloudy morning—Red River at a stand
" 3	69	76	74	..	cloudy—hail and rain and thunder at night
" 4	74	84	76	..	clear all day—Red River falling
" 5	62	76	74	w	..
" 6	67	75	72	NW	..
" 7	52	68	62	w	.. —at 1 p. m. thunder showers, rain and hail
" 8	50	62	72	high	..
" 9	58	81	68	..	..
" 10	64	85	78	..	..
" 11	62	78	76	calm	.. .. ..
" 12	64	82	76	..	cloudy
" 13	66	82	70	..	.. —rain in the evening
" 14	60	62	62	NE	.. —rain all day and night
" 15	60	64	62	..	.. — .. .. ..
" 16	62	72	72	calm	clear all day
" 17	60	78	75	..	.. —cloudy at noon—wind, NE
" 18	64	78	72	SE—high	cloudy all day
" 19	67	72	70	calm	.. —rain
" 20	68	76	71	SE	..
" 21	66	78	79	..	..
" 22	68	82	77	calm	clear
" 23	68	88	78	..	..
" 24	66	84	78	N—light	..
" 25	67	84	79	calm	..
" 26	69	85	82	..	..
" 27	70	86	82	..	..
" 28	72	88	84	..	..
" 29	70	78	68	..	cloudy—heavy rain in evening and night
" 30	66	76	76	..	clear all day [8 ft. 7 in.
" 31	68	78	88	..	.. .. —Red River fell this month 4 ft. 8 in.—below high water mark,
June 1	74	86	82	..	cloudy—Red River falling
" 2	74	86	84	..	clear—saved first crop red clover hay
" 3	74	88	84	..	..
" 4	76	86	84	s—light	cloudy morning—clear day—digging Irish potatoes
" 5	77	88	84	..	clear
" 6	78	90	83	..	.. all day
" 7	72	89	84	calm	.. ..
" 8	73	87	92	..	.. .. —cutting oats
" 9	72	86	82	s	.. ..
" 10	73	90	83	SW	.. —evening calm and cloudy
" 11	74	88	82	w—light	cloudy morning—evening clear—wind N
" 12	68	86	80	calm	clear all day
" 13	70	90	84	SW—light	.. —flying clouds
" 14	71	90	82	..	.. —evening, distant thunder—tomatoes ripe
" 15	70	88	82	..	.. — .. ..
" 16	73	83	76	s	.. —evening, cloudy and distant thunder
" 17	73	82	74	calm	cloudy— .. .. .. —finished cutting oats
" 18	74	84	78	..	clear— .. .. ..
" 19	70	89	82	N—light	.. — .. .. .. —ochre for use
" 20	73	86	80	calm	.. —foggy morning—evening, a light shower
" 21	70	80	69	NE—high	.. —clear evening—at 1 p. m. to 7 p. m. a severe gale & heavy rain—corn
" 22	70	88	80	..	.. blown down
" 23	76	88	82	S—light	cloudy—light shower
" 24	74	81	76	S	.. — .. ..
" 25	74	86	74	..	.. evening—heavy thunder shower
" 26	72	89	84	S—light	clear— .. .. ..
" 27	74	89	84	..	..
" 28	74	88	82	..	..
" 29	72	86	82	..	.. [water mark, 17 ft. 1 in.
" 30	75	90	—	..	.. —evening rain—Red River fell this month, 8 ft. 6 in.—now below high

P. S.—The storm on the 21st of June injured our crops of corn very much.

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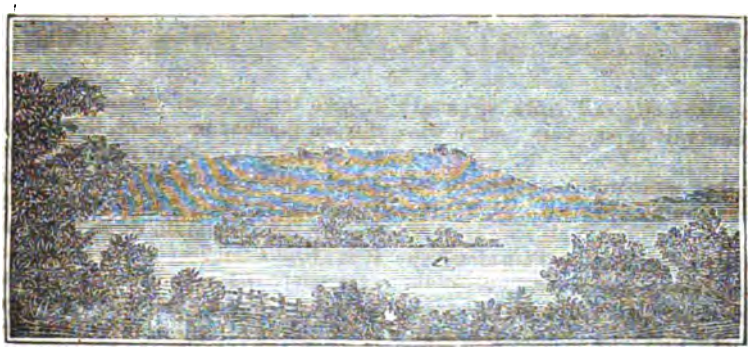
MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING SEPTEMBER 20, 1834. [NUMBER 3.

"A taste for knowledge, a capacity to acquire it, and a pleasure accompanying its acquisition, form the constitution of every mind."—DR. DICK.



History of Astronomy—its various Systems, &c. [Continued from page 101.]

OF THE STRATUS.—This modification has a mean degree of density.

It is the lowest of clouds, since its inferior surface commonly rests on the earth or water, as represented by the figure above annexed.

Contrary to the last, which may be considered as belonging to the day, this is properly the cloud of night, the time of its first appearance being about sun-set. It comprehends all those creeping mists which in calm evenings ascend in spreading sheets (like an inundation of water) from the bottom of valleys, and the surfaces of lakes, rivers, &c. &c. Its duration is frequently through the night.

On the return of the sun, the level surface of this cloud begins to put on the appearance of cumulus, the whole at the same time separating from the ground. The continuity is next destroyed, and the cloud ascends and evaporates, or passes off with the appearance of the nascent cumulus.

This has been long experienced as a prognostic of fair weather, and indeed there is none more serene than that which is ushered in by it. The relation of the stratus to the state of the atmosphere, as indicated by the barometer, &c. appears notwithstanding to have passed hitherto without much attention.

OF THE CIRRO-CUMULUS.—The cirrus having continued for some time increasing or stationary, usually passes either to the cirro-cumulus or the cirro-stratus, at the same time descending to a lower station in the atmosphere.

The cirro-cumulus is formed from a cirrus, or from a number of small separate cirri, by the fibres collapsing as it were, and passing into small roundish masses, in which the texture of the cirrus is no longer discernible, although they still retain somewhat of the same relative arrangement, as exhibited by the following figure. (See next page.)

This change takes place either throughout the whole mass at once, or progressively from one extremity to the other. In either case the same effect is produced on a number of adjacent cirri at the same time, and in the same order. It appears in some instances to be accelerated by the approach of other clouds.

This modification forms a very beautiful sky, sometimes exhibiting numerous distinct beds of these small connected clouds, floating at different altitudes.

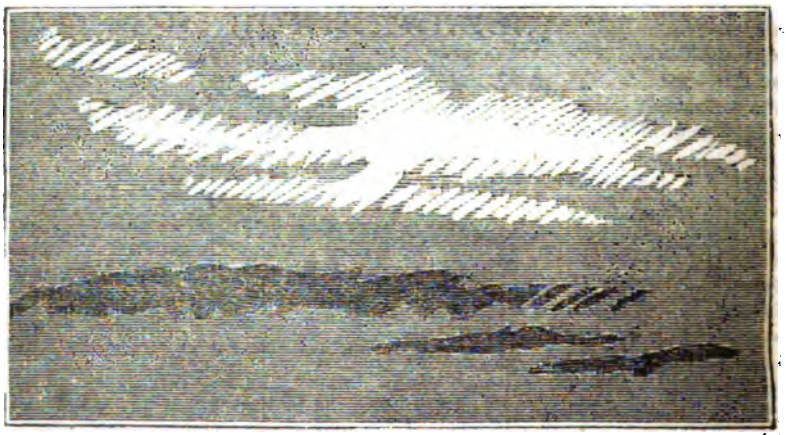
The cirro-cumulus is frequent in summer, and is attendant on warm and dry weather.

It is also occasionally and more sparingly seen in the intervals of showers, and in winter.

It may either evaporate or pass to the cirrus or cirro-stratus.

Of the Cirro-Stratus.—This cloud appears to result from the subsidence of the fibres of the cirrus to a horizontal position, at the same time that they approach towards each other laterally. The form and relative position, when seen in the distance, frequently give the idea of shoals of fish. Yet in this, as in other instances, the structure must be attended to rather than the form, which varies much, presenting at other times the appearance of parallel bars, interwoven streaks, like the grain of polished wood, &c. It is always thickest in the middle, or at one extremity, and extenuated towards the edge, as represented by the following figure.

The distinct appearance of a cirrus does not always precede the production of this and the last modification.



The cirro-stratus precedes wind and rain, the near or distant approach of which may sometimes be estimated from its greater or less abundance and permanence. It is almost always to be seen in the intervals of storms. Sometimes this and the cirro-cumulus appear together in the sky, and even alternate with each other in the same cloud, when the different evolutions which ensue are a curious spectacle, and a judgment may be formed of the weather likely to ensue, by observing which modification prevails at last. The cirro-stratus is the modification which most frequently and completely exhibits the phenomena of the solar and lunar halo, and (as supposed from a few observations) the parhelion and paraselene also. Hence the reason of the prognostic for foul weather, commonly drawn from the appearance of the halo.

Of the Cumulo-Stratus.—The different modifications which have been just treated of sometimes give place to each other,

at other times two or more appear in the same sky; but, in this case, the clouds in the same modification lie mostly in the same plane of elevation; those which are more elevated appearing through the intervals of the lower, or the latter showing dark against the lighter ones above them. When the cumulus increases rapidly, a cirro-stratus is frequently seen to form around its summit, reposing thereon as on a mountain, while the former cloud continues discernible in some degree through it. This state continues but a short time. The cirro-stratus speedily becomes denser, and spreads, while the superior part of the cumulus extends itself and passes into it, the base continuing as before, and the convex protuberances changing their position, till they present themselves laterally and downward. These are well represented by the following figure.

More rarely the cumulus alone performs this evolution, and its superior part constitutes the incumbent cirro-stratus.

In either case a large lofty dense cloud is formed, which may be compared to a mushroom, with a very thick short stem. But when a whole sky is crowded with this modification, the appearances are more indistinct. The cumulus rises through the interstices of the superior clouds, and the whole, seen as it passes off in the distant horizon, presents to the fancy mountains covered with snow, intersected with darker ridges, and lakes of water, rocks, and towers, &c.

The distinct cumulo-stratus is formed in the interval between the first appearance of the fleecy cumulus and the commencement of the rain, while the lower atmosphere is yet too dry; also, during the approach of thunder storms; the indistinct appearance of it is chiefly in the longer or shorter intervals of showers of rain, snow, or hail.

The cumulo-stratus chiefly affects a mean state of the atmosphere as to pressure and temperature, but in this respect, like the other modifications, it affords much room for future observation.

Of the Nimbus, or Cumulo-Cirro-Stratus.—Clouds, in any of the preceding modifications, at the same degree of elevation, or in two or more of them, at different elevations, may increase so as completely to obscure the sky, and at times put on an appearance of density, which, to the inexperienced observer, indicates the speedy commencement of rain. It is nevertheless extremely probable, as well from attentive observation as from a consideration of the several modes of their production, that the clouds, while in any one of these states, do not at any time let fall rain.

Before this effect takes place, they have been uniformly found to undergo a change, attended with appearances sufficiently remarkable to constitute a distinct modification, which is represented by the following figure, called the Nimbus, or Cumulo-cirro-stratus cloud. (See next page.)

In this figure a shower is represented as coming from behind an elevated point of land.

The nimbus, although in itself one of the least beautiful clouds, is yet now and then superbly decorated with its attendant, the rainbow, which can only be seen in perfection when backed by the widely extended uniform gloom of this modification.

The relations of rain, and of periodical showers more especially, with the varying temperature, density, and electricity of the atmosphere, will probably now obtain a fuller

investigation, and with a better prospect of success than heretofore.

Remarks on the Rival Claims to the Introduction of Steam Navigation. [From the London Mechanics' Magazine.]

Sir,—It must be evident to every one, that not only England, but the whole of the civilized world, is under immense obligations to the individual who first rendered steam available to the purposes of navigation. Public opinion, however, seems still to vibrate between the conflicting claims to this honor put forward by the late William Symington, Mr. Miller, of Dalswinton, (or rather by his representatives on his behalf,) and Mr. Jas. Taylor. As to those of Fulton* and Bell, they seem, according to common consent, to be wholly untenable.

We will, if you please, begin "wi' the laird" first. Mr. Miller was a man of property, possessed of an active mind, which was constantly requiring excitement. He was, therefore, always ready to enter into any experiments which promised to afford him that mental stimulus congenial to his feelings. He was, consequently, very ready to assist with his patronage young men who possessed inventive genius, or supposed that they were so blessed, and, of course, was very commonly disappointed. As he was easily induced to begin experimentalizing, he was just as apt to quit it without carrying it on to a successful result. For, although not deficient in wealth, he lacked that spirit of perseverance from which alone success can emanate.

Taylor was a tutor in this Mr. Miller's family. He had been on terms of intimacy with William Symington, when at the University of Edinburgh, and had seen a model of an improvement which Symington (though then still a very young man) had just perfected in the steam engine. In consequence, it would seem, of some mention made to Mr. Miller of Symington, (very probably by Taylor,) Mr. Miller, early in 1786, called upon Symington, who was then in the employment of, and residing with, Mr. Gilbert Meason, the manager of the Wanlock-Head Mining Company, and after conversing with him for some time, engaged him to make some experiments, for the purpose of ascertaining the practicability of propelling boats by steam. Miller himself had, previously to this, attempted to move boats by means of wheels, set in action by treddles, a plan which he was compelled to abandon from the excessive fatigue it occasioned to the men employed. This scheme, by the way, had not even the charm of novelty to recommend it, for it had been practised by the Romans, who used oxen to work machinery; and also by Savary, who had, like Mr. Miller, exerted human force for that purpose.*

The biographer of Taylor, in "Chambers' Journal," states that he "attended the University of Edinburgh for several years;" that the classes selected by him were anatomy, surgery, and chemistry; and that he "prose-

* We shall shortly have something more to say on this subject. Fulton most certainly had some claims: to what extent we shall examine shortly.—[Ed. Am. M. M.]

* Mr. Miller seems to have had a predilection for appropriating other persons' inventions to himself; or, if he had not, his friends have endeavored to do so for him, as they would willingly have us to believe that the piece of sea ordnance, known as the carronade, was the fruit of Mr. Miller's genius, when, in fact, it was invented by Mr. Gascoigne, one of the proprietors and managers of the Carron Iron Works, from which circumstance it derived its name.

cuted his studies with much assiduity and success, for at the end of his course he was prepared to enter *either* upon the profession of medicine or divinity"!! Now, if the College Album be an authority to be confided in, Taylor matriculated for *one* season only, and attended the classes above mentioned for one course each. "One swallow," says the adage, "does not make a summer;" but according to Taylor's biographer, one course of lectures fully qualified him to be either a physician or a divine? I make no doubt that he was just as well qualified for the one as the other—that is, not at all. I agree with the writer in "Chambers' Journal," that his genius was excursive, and that to a very considerable extent; but I have yet to learn, that its excursions were ever attended by any beneficial result. He is said to have had a predilection for mineralogy, geology, and mechanics; but if this were true, how comes it that Taylor, being at the University where those subjects were treated upon scientifically, never availed himself of so excellent an opportunity of attending the classes in which they were taught?

The improvement of the steam engine, devised by Mr. Symington, was accomplished in 1785–1786, and it was in the spring of 1786 that Mr. Miller, as already mentioned, engaged him to carry on some experiments upon steam navigation. These were made upon the lake at Dalswinton, Mr. Miller's property, in 1788. It is asserted that Mr. Taylor remained in Edinburgh after Mr. Miller had left, to superintend castings of the parts of the engine intended to be employed in moving the boat. But if this were necessary, why did not Taylor afterwards put the engine together? If he were capable of furnishing the drawings and models by which the various parts were to be constructed, surely there could be no necessity for sending for Mr. Symington from the Lead hills, to put the different pieces properly "*in situ*." Mr. Miller would have been little less than mad to employ Symington in these experiments, when he had such a brilliant and inventive genius as Taylor residing under his own roof. If (as has been asserted) Taylor was the author of these experiments, where are the drawings and documents to substantiate his claim? Have they ever been seen by any person? Or, indeed, have they ever existed, except in the imagination of his partisans?

There is an account of these experiments to be found in the "Scots Magazine" for 1788, which it has been allowed was drawn up by Taylor himself. He acknowledges, in this statement, that the merit of the expense of trying the experiment was due to Mr. Miller, but that the engine used upon the occasion was the sole invention of Mr. Symington, and throughout the whole account he never introduces his own name, either directly or by implication. The notice alluded to is subjoined.*

In 1789, Taylor is represented as being located at the Carron Iron Works, for the purpose of superintending the castings of an engine of increased size, the cylinders being 18 inches in diameter. But in opposition to this, we have the affidavit of Mr. Stainton, one of the managers of these works, who states that—

"He (Taylor) was never considered capable of superintending the work; that he never furnished a single drawing or model by which the work might be forwarded; but that, on the contrary, Mr. Symington was looked up to as being the person to whom all the necessary inquiries for the completion of the engine were to be addressed; and that, so far from considering Taylor as a principal, he was rather looked upon as a spy, appointed by Miller to watch Symington's conduct, that he did not waste too much of his time upon some experiments he was conducting at the same moment for the Wanlock-Head Company."

The experiments with the new engine succeeded entirely; but when it had arrived at that point, that by a little more exertion it might have been perfected, Mr. Miller's excitement was over. He had been bitten by an agricultural mania, dismantled the steamboat, and left steam navigation to be promoted by other hands.

In 1801 and 1802 Mr. Symington renewed his experiments under the patronage of Lord Dundas, that nobleman having purposely gone down from London to engage him. He continued them until 1803, when he completed a steam tug, which towed two merchant vessels 19½ miles upon the Forth and Clyde canal, against the wind, in the presence of many spectators. Mr. Symington

* "On October 14 a boat was put in motion by a steam engine, upon Mr. Miller of Dalswinton's piece of water at that place. That gentleman's improvements in naval affairs are well known to the public. For some time past his attention has been turned to the application of the steam engine to the purposes of navigation. He has now accomplished, and evidently shown to the world, the practicability of this by executing it upon a small scale. A vessel 25 feet long and 7 broad was on the above date driven with two wheels by a small engine. It answered Mr. Miller's expectations fully, and afforded great pleasure to the spectators. The success of this experiment is no small accession to the public. Its utility in canals, and all inland navigation, points it out to be of the greatest advantage, not only to this island, but to many other nations of the world. *The engine used is Mr. Symington's new patent engine.*"—[Scots Magazine, Nov. 1789, p. 566.]

took out a patent in the usual way for the protection of his invention in 1801; and this fact must dispose of the charge of his having practised any concealment or secrecy with regard to the matter.

A letter has been published, from Mr. Symington to Taylor, in which the former promises to make over half the profits of the invention to the latter. This originated, I am told, in a representation made by Taylor, that he was possessed of considerable influence amongst noblemen and members of parliament, through whose intercession a parliamentary grant might be obtained. But even supposing Mr. Symington was not entitled to the honor of being the first applier of steam to the purposes of navigation, Taylor, from his own showing, and from that of his friend, must have still less claim; for he states, that he (Taylor) called upon Mr. Miller, and endeavored to persuade *him* to secure the right to the invention by a patent. If it was Miller's invention, Taylor's regretting his own incapability of securing the right by patent is an absurdity.

Taylor's real friends cannot be much obliged to Mr. Chambers for his biography, for it certainly exhibits him in any thing but an amiable point of view. We find him, in the first place, acting as a spy upon his intimate friend Symington, and afterwards engaging in a secret correspondence with his patron Mr. Miller's most intimate friends, for the purpose of robbing him of the fruits of his experiments, by taking them away to a foreign country; and this he did after having vainly endeavored to make Miller as dishonest as *he* wished to be, in taking out a patent to secure to himself the profits of another man's genius.

If Mr. Symington had not expended his private fortune previously to 1815, and which he did in experimentalizing, there would not have been any occasion for this letter, as there would have then been ample legal proof on record of the originality of his invention. I am, sir, yours obediently,

CH.

London, May 28, 1834.

[We have great pleasure in inserting the preceding communication, because, though it contains little that is new on the subject of Mr. Symington's claims, and puts some points less forcibly than has been already done in our pages, (see particularly vol. xix. p. 121,) it is the spontaneous production of a physician who holds a high place in public opinion, and serves to show these claims are gaining ground among those enlightened and reflecting classes of the community with whom the decision of all such matters must ultimately rest. We feel persuaded that the time is now but little distant, when we shall have to congratulate the family of Mr. Symington on the complete and triumphant recognition of his title to be regarded as the first person who practically demonstrated the immense benefits to be derived from the application of steam power to navigation. —ED. LOND. M. M.]

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 72.]

MISCELLANIES.

Q. How are *Artificer's works* appreciated in the Metropolis?

A. At *fair measure and value prices*, agreeably to a given standard.

Q. What are the walls of houses principally built of in town?

A. Bricks—known of different qualities, as *common place, grey stocks, pickings, seconds, marles, cutters, paviors, &c.**

Q. How are bricks worked?

A. In headers or stretchers, laid either in *Flemish bond* or *English bond*.

Q. What is Flemish bond?

A. Bricks laid alternately in a course—first a stretcher, then a header—which is the general custom.

Q. What is English bond?

A. When one course of bricks is stretchers, and the other course headers, and so on alternately.

Q. How is brickwork measured and valued?

A. By the *rod*.

Q. What are the foundations of brickwork called?

A. Footings.

Q. What are *reveals?*

A. External recesses of four inches thick, formed by the recess of the window frames. Sometimes there are double reveals introduced, which become ornamental.

Q. What are *gauge arches?*

* The making of bricks deserves record—Kent and Essex claim precedency over all other counties in the art. In the first instance, clay and chalk are collected in large quantities, and brought to the *pug mill* (a large vat) placed in a circular excavation, in which an iron spindle with horizontal blades is fixed, and from which spindle a shaft projects, having a horse harnessed, and travelling round grinds the soil, which, emptying itself into the excavation, at the same time water is pumped therein, forms a liquid, and passing through a grating falls into a large *back* prepared for the purpose. Here the mixture is allowed to remain until it becomes a solid body. A certain portion of ashes is then strewed over the surface, and mixed with the same, which is again brought to the pug mill, ground, and taken to the hands of the brickmaker, who moulds it; from him it is conveyed to the *hacks* (prepared level surface of earth,) where the bricks are all disposed in long ranges, and in two lengths transversely, a little open to admit air, and carried to the height of four feet, where they remain from ten to twenty days, till hardened by the atmosphere and sun. They are then regularly disposed on a large area of level ground, with *breeze* (fine cinders) laid on the surfaces of every seventh or eighth tier, and then set on fire; hence, a pile, called a *clamp*, containing from half a million to two millions of bricks, is formed, and the bricks gradually burnt and produced in such qualities as the soil and the fire have combined to effect. The best bricks, as marles, paviors, &c. have the greatest quantity of chalk. Pantiles, plaintiles, &c. are made in a similar manner.

A. They are either straight, circular, or elliptical, forming a *fascia*, and are bricks rubbed, and neatly set in putty or mortar—radiating from a given centre, and presenting their several thicknesses as stretchers and headers, or closers.

Q. What are *splays*?

A. The interior or exterior obtused angles of the sides of doors, windows, &c.

Q. What are *quoins*?

A. The external angles of the buildings.

Q. What are *ramps*?

A. Segmental or elliptical sweeps in a wall that is erected on an inclined plane, to give it nearly an equal height all along.

Q. What is *coping*?

A. The summit of the wall; the bricks being laid edgeways, presenting themselves as headers.

Q. What are *strings*?

A. Longitudinal projections of different depths, in fronts, &c. of buildings.*

Q. What are *party walls*?

A. The division walls of rows of houses.

Q. What are *chimney breasts*?

A. Brickwork projecting from the walls to form the hearth; the piers on each side are termed the *jaumbs*, through which, in upper stories, the *flues* of the chimney pass to the *shaft*, which forms the chimney.† In the internal part, the chimney breast *splays*, which is called the *wings* to the entrance of the flues, which are one and a half brick by two bricks square.‡

Q. What is *nogging work*?

A. Brickwork laid between the partition framing, and is worked in brick of four inches thick, agreeably to the partition frame.

Q. What is *pointing* of brickwork?

A. The filling up of the joints of brickwork, denominated *flat joint* in the common manner, or *tuck jointed*, done with cement, in a superior manner, over grey mortar.

Q. What is meant by *scaffolding*?

A. The erection of spars, called *scaffold poles*, around the buildings, which are severally lengthened by others being lashed to them by ropes, as the work is carried up; and *putlocks*, the cross pieces, one end tied to the poles, and the other resting on the brick or stone work, for the purpose of laying the deals on. In large and high buildings, particularly steeples, columns, &c. great ingenuity is requisite to maintain sufficient strength in the unison of these parts. *Guys* or ropes are frequently had recourse to, leading from the summit of the scaffolding to some post driven in the ground, at a distance from the building.

Q. What is meant by the *carcase* of a house?

A. Simply the stone or brickwork, with the roofing, joists, and partitions.

Q. How are *sewers* or *drains* constructed?

A. With bricks or stones, in various arches—as semi-circular, elliptical, scheme, square, &c. The lesser drains are circular, and denoted as *gun-barrel drains*. Their constructions are liable to Acts of Parliament.

PLASTERER.

Q. What is plasterer's work?

A. The plastering of a building internally wants several coats, denominated *rough rendering*, being the first coat of plaster on walls—*floated rendering* the second coat, of fine lime and hair—and *set work*, the third coat, *fine stuff*, part lime and sand. On partitions and ceilings, *lath and plaster and set*, or *floated lath and plaster set*.

Q. How are the best rooms finished internally?

A. The walls are *trowelled stucco*, i. e. plastered with fine lime and sand, and lime water, with the smoothest surface.

Q. How are external walls finished?

A. Sometimes *rough cast*, (a rough plaster thrown thereon, called *slap-dash*,) but frequently *rough stuccoed*, presenting the appearance of stone work, with rustics, &c.

Q. What is *lime*?

A. A viscous substance, and is known as *chalk lime* and *stone lime*. The former partakes of two qualities, as *flame lime*—the chalk being burned in large lumps, in kilns, by furnaces beneath, heated with coals, and is of a much stronger nature than the *tunnel lime*, burnt in a tunnel kiln, in small pieces of chalk, mixed with culm, cinders, breeze, or ashes, in equal proportions. *Stone lime* is burnt with coals, or culm, in kilns, and is of greater strength than either.

Q. What is *mortar*?

A. Lime and sand,* mixed in equal pro-

NOTE.—Walls are said to *batter* when the external face at the base projects and diminishes upwards to any given height, and then carried up perpendicularly, as batteries, &c. The proportion is one inch in a foot.

* Cornices, pilasters, plinths, strings, sills, &c. are frequently worked in bricks.

† In large buildings all the flues of the several chimneys are brought to the centre shaft, the same being sprung by arches from their respective chimney breasts.

‡ An Act of Parliament was passed in 14 Geo. III. cap 78, entitled "An abstract of the London Building Act," dividing buildings into seven classes, regulating all party walls, chimneys, &c.

* Lime, a very useful earth, which absorbs moisture and carbonic acid, and exists as lime stone, and in marble and chalk, which when burnt becomes lime. It consists of oxygen and a metallic base called calcium. It fixes the gaseous constituents of water, which in losing their motion transfer it in great heat to surrounding bodies. In its native state it is called carbonate of lime, and burnt to disengage the carbonic acid. When made into a paste of one

portions according to the strength of the former, with water, and is used for laying of stones, bricks, plastering, &c.

Q. What is *Roman cement?*?

A. A composition of lime and earth, by which all external ornaments, as sills, pilasters, cornices, rustics, &c. are worked.

Q. What are *Terras* and *Pozzolona?*

A. Terras is a volcanic production, consisting chiefly of clay and oxide of iron, indurated together. Pozzolona is another volcanic production, differing but little from the former. It is thrown out of volcanoes in the form of ashes, and abounds in the kingdom of Naples. The cement used in the construction of the Eddystone lighthouse is composed of equal parts of lime and pozzolona, as best adapted for marine purposes.

Q. What is *Plaster of Paris?*

A. *Burnt gypsum*, a combination of 42 parts of lime and 58 of sulphuric acid, with which all enrichments for cornices, soffits, fretts, flutings, festoons, husks, flowers. &c. are cast, and attached to the ceilings.

CARPENTER.

Q. What is carpenter's work?

A. The rough timber work, as *girders*, severally introduced into large buildings, to support the joists; *oak joists* and *sleepers*, for the ground floors; *wall plates*, to receive the ends of joists on, which are framed by *trimmers* to fire places, and the *well holes* of staircases. *Lintels*, (generally oak,) thrown over all apertures, to receive any contingent pressure. *Bond timber*, worked longitudinally into walls, to give additional strength, and receive any fastenings. *Quarter partitions*, framed, consisting of *heads*, *sills*, *quartering*, *enterties*, *braces*, *puncheons*, &c. stretching across the joist; or *skeleton partitions*, simply, quartering nailed to the joist, without heads, sills, &c. The roofing of the building, with *binders*, *ceiling joist*, also *brest summers*, for shop fronts, and *story posts* to support the same, all *luffer boarding*, or *weather boarding*, together with *cradling for centres*, &c. Also *fencing* to parks, and *rough work* in general.

JOINER.

Q. What is joiner's work?

A. The completion of the wood-work in the several houses, as laying of floors, making doors, window frames, sashes, shutters, &c.

Q. How are floors designated?

A. According to the quality of timbers used—as rough-inch deal, white or yellow edges, shot (*i. e.* planed fair); inch wrought folding white or yellow, (*i. e.* several deals are laid within certain breadth and secured by dogs, and are then pressed down by weight, uniting the joints very compactly and closely;) inch deal (white or yellow) straight joint, (*i. e.* all the joints running in fair lines, the deals being of equal breadth;) inch floor, (white or yellow,) ploughed and tongued headings, edges nailed, (*i. e.* the extremities of the boards, at the hearths, &c. are grooved into a piece running at right angles, making the whole fair;) whole deal dowelled floor, (*i. e.* when the edges of the boards are shot or made fair, small holes are bored into their close sides, and wooden pins or dowels are introduced when the same are united together.) Other floors, for granaries, &c. are ploughed or rebated, and feather-tongued, (*i. e.* when one edge laps over the other about three quarters of an inch, and tongues introduced into each side, similar to dowelling;) straight-jointed batten floors, (from 4 to 7 in.) grooved and tongued. The best floors are sometimes of oak or wainscot.

Q. How are windows made and denominated?

A. The frame is case-work, to admit of the weights, and divided by *stops* for the sashes to traverse in; the lower part of the frame is of oak—solid; the sashes are made to fit the aperture of various thicknesses, and moulded bars: hence, in measuring such work, it is said, four-inch deal cased frame, oak-sunk sill, two-inch astragal and hollow bars, (or otherwise,) hung double, (or single,) with pulleys, weights, lines, &c.—or, two-inch French casements with circular heads, hung folding, with marginal spaces, &c. (Frame measured separately.)*

Q. How are doors made?

A. In different pieces. The perpendicular parts are the *hanging stile*, to which the

part water with three parts lime, it is called hydrate of lime; and being mixed with silica, alumina, and oxide of iron, it forms plastic cements, and mortars; and afterwards imbibing carbonic acid from the atmosphere, it becomes again a carbonate of lime, as hard as at first: and hence it is used in building. *Slake lime* is so called when it has been wet or damaged. The tunnel lime is much used in the eastward for manure, as also the stone lime in the westward. Northfleet, in Kent, and up the river Medway, are places noted for chalk lime. Chalk, carbonate of lime,—56 lime, 41 carbonic acid, when pure. Sand is pulverized rocks of silex, &c. and it is known as *clean* or *round* sand, and *sharp* sand, which consists of grains with flat surfaces, and when enveloped and cemented together by the lime paste, possesses much stronger power of cohesion than the globular, and is taken out of the Thames above Woolwich.

* The laws of symmetry and strength alike require windows to be exactly one over the other; although our ancestors deviated so strangely. To determine the aggregate area of the windows proper to be made in an apartment, extract the square root of the curvature of such apartment, and the quotient will be the answer. Nor should the apertures be made too high, as the effect of cornice, architrave, &c. is totally destroyed. The number of windows depend on the strength, local position, and elevation of the building.

hinges are affixed—the *closing stile*, to which the locks, &c. are affixed—and the *muntins*, the central pieces. The horizontal pieces are *top rail*, *second rail*, *middle rail*, and *bottom rail*: they are all grooved to secure the *panels* in the intermediate spaces, which are moulded, raised, &c. Doors vary in thickness, from three inches to one, and descend from the most ornamental door down to the common ledged door.*

Q. What are shutters?

A. They differ, like doors, in construction and size. In respectable houses they are fitted in *proper boxings* (*i. e. casings* with *linings*, &c.) and hung with *back flaps*, whilst the *soffits* of the windows, the *backs* and *elbows* (the parts beneath the windows,) correspond in panelling and mouldings. The architraves to the windows finish the internal part of the window, with which those of the doors, recesses, &c. should assimilate. Closet doors, dwarf closets, and doors, should be made the same.

Q. What are door-cases?

A. The frames of doors, and are known as *proper door cases*, *double* or *single rebated*, *&c*, one side or both sides.

Q. What are skirtings?

A. The boards in the lower part of rooms or lobbies, staircases, &c. finishing the flooring and the plastering of the wall. They are designated according to their mouldings as *torus*, *double torus*, *reeded*, *&c.* and are either *raking* or *straight*.

Q. What are *surbases?*

A. Mouldings running round the room as a protection to the wall. The intermediate part is termed the *dado*—sometimes panelled, and sometimes plastered.†

Q. What of *staircases?*

A. They are of several forms, arranged according to conveniency, neatness, or grandeur of appearance: these come under the head of *plain* or *straight*; *dog-legged*, (*i. e.* having, halfway up, a landing called a *quarter space*, or *half space*, if twice the size, from whence the flight is continued the opposite way); *elliptical*, *circular*, (all the stairs being winders), *geometrical*, &c.‡

Q. What are the component parts of a staircase?

A. The *treads*, the flat spaces, (if straight, designated *flyers*; if angular, *winders*;) the *risers*, the perpendicular parts of which support the treads; the *strings*—as wall-string, the string into which the treads and risers are framed; the *carriage*, pieces of quartering running longitudinally under the stairs, to support them; *quarter and half spaces*, *hand-rail newels*, and *balusters*. In superior staircases, of whatever figure, they come under a different denomination, as *risers*, and *treads*, with *rounded* and *moulded nosings*, framed to *wall-string*, with *cut string*, *returned* and *mitred ends*, and *moulded brackets*; mahogany *hand-rail* ramped with *curtail step* and framed *balusters*; carved *newels* with *pendants*, *&c.*

Q. What else come under notice in joinery?

A. Framed closet fronts, with doors for chambers and kitchens, framed spandrils for staircases, plain linings, window-boards, kitchen-dressers with drawers, pot-boards, cut brackets and shelves, fascias, mantel-pieces, shoots, and water-trunks, catilivers and balcony bottoms, verandas, with canopies, trellis-work, &c.

Q. What are the several mouldings used in joinery for skirtings, architraves, and windows?

A. 1, rounded. 2, ovolo. 3, cavetto. 4, quirked bead, or bead and quirk. 5, bead and double quirk, or return bead. 6, double bead, or double bead and quirk. 7, single torus. 8, double torus. 9, cima recta. 10, cima reversa. 11, quirked ogee. 12, quirked ovolo. 13, scotia. 14, single reed. 15, double do. 16, triple do. 17 and 18, reeds round convex surface of a cylinder. 19, astragal and half-round bar. 20, quirked astragal bar. 21 and 22, quirked gothic bars. 23, double ogee bar. 24, quirked astragal and hollow bar. 25, double reeded bar. 26, triple do.

Q. How are doors described?

A. 1, square and flat panel both sides. 2, quirked ovolo, fillet and flat panel, with square back. 3, quirked ovolo, bead and flat panel, with do. 4, quirked ovolo, bead, fillet, and flat panel, with do. 5, quirked ogee, quirk bead, and flat panel, with square

* In the proportion for small doors generally three feet wide, the height is to the breadth in the ratio of 7 to 3. The height of large doors need not be more than double their breadth. The doors of mansions may be six feet wide; those of public edifices from six to ten feet wide; but these should be folding. Where two doors are thrown into one, by folding doors, the width of the aperture is generally of less height than twice its breadth.

† In genteel houses, the skirting and surbase are superseded by a deep *plinth*, with a rich moulding running on the top of it.

‡ The fixing the situation of a staircase, and deciding the form of the same, affords one of the strongest proofs of an architect's skill. In mansions and palaces, the steps should not be less than four, nor more than six inches high; nor more than eighteen, nor less than twelve inches broad; the width should not be less than six, nor exceed fifteen feet. In ordinary houses, the steps average from six to seven inches high, twelve inches wide, and three feet long. In setting off the staircase, of whatever form, calculate the height from one floor to the other, reduce the same to inches, and divide by the height of the steps, the number of steps will be given. Care must be taken to admit of sufficient height for door-ways, over which they may be thrown.

back. 6, cove, raised bead, and flat panel with square back. 7, quirked ogee, raised bead, and flat panel with square do. 8, quirked ovolo, bead, fillet, and raised panel on front, with square back. 9, quirked ovolo, bead, and raised panel with ovolo on the rising on front of door, with square back. 10, quirked ogee, raised panel, ovolo, and fillet, on rising, and astragal raised on the flat of panel and square back. 11, quirked ovolo, bead and fillet, and flat panel on both sides. 12, bead and but front with square back. 13, bead, flush front, and quirked ogee, raised panel with ovolo on the rising ground on flat of panel on brick. 14, Bilection moulded door.*

STONE-MASON.

Q. What are the different stones used in building?

A. Portland, Bath stone, Yorkshire, and Purbeck; to which may be added, stone found in neighboring districts, as granite, lime stone, and slate; all of which, according to the several purposes, are measured by the foot *cube* (solids above four inches thick); *super* (to all squares and flat surfaces under four inches, as *landings*, &c.); *lineal* (to grooving, throating, Yorkshire and Purbeck steps, and channel stone).

Q. For what purposes is stone used?

A. In some instances throughout buildings, and also for bridges—and columns—in others, for casing fronts of buildings: hence termed *ashlar fronts*—also for paving, plinths, strings, sills, steps, quoins, keystones, copings, parapets, mantel jaumbs, hearths, sinks, &c.†

Q. What are the different kinds of marble?

A. There are several; namely, *statuary*, (the most valuable,) *veined*, *dove*, *black and gold*, *black*, *speckled*, *sienna*, and *Elgin*.

Q. For what is marble appropriated?

A. For tombs, monuments, pavements of halls, (being tesselated, giving a pleasing effect,) sometimes columns, grouping, &c. and for mantel-pieces.

Q. How is stone-work secured?

A. It is bedded in mortar or cement, and frequently cramped by small pieces of iron being let in, and bedded in lead.

PLUMBER.

Q. What does plumbers' work embrace?

A. The leading of roofs, gutters, cisterns, pumps, pipes of several sizes, solder, &c. all of which is measured by the square and lineal foot. It also includes fittings to water closets, as stop-cocks, bibbs, stop-bibbs, balls, ball-basses, butts, ferrols, washers and wasters sockets, plugs, &c.

PAINTER.

Q. How is painters' work described?

A. It is done in one, two, three, and four oils, in different colors and shades—imitations of wainscot, oak, satin wood, &c. and then *flatted* by turpentine—all being previously *knotted*.

Q. How is painter's work measured?

A. Wherever the brush goes: all wainscot, dado, doors, window-shutters, jaumbs-linings, mouldings, architraves, &c. are measured by the *yard square*. Chimney pieces, ornamented ceilings, and other enriched, worked, picked in, and small detached pieces, done with variegated or fancy colors, &c. by the *foot square*. Ornamental figures, carved mouldings, cornices, fascias, skirting, water-trunks, &c. by the *foot running*. Sash frames, window-lights, casements, &c. per *piece*; and sash squares by the *dozen*.

GLAZIER.

Q. What is glaziers' work?

A. The glazing of all windows, which is measured by the foot superficial, from rebate to rebate.

Q. What are the different qualities of glass?

A. Plate glass, best Newcastle crown glass, second do., third do, packing and green glass, and ground glass.

BLACKSMITH.

Q. How is blacksmiths' work charged?

A. By the *hundred weight*, namely, 112 pounds, to doors, columns, &c.; by the *pound* to smaller weights; by the *foot lineal* or *super* to railings, balconies, trellises, &c.

NOTE.—Iron-wrought doors, with panels, &c. are directed by Act of Parliament, for dividing large warehouses and stables.

Q. What branches of science are immediately connected with architecture?

A. A knowledge of the classics, the acquisition of geometry, and perspective, and the art of drawing; but above all, to be well skilled in the properties of the materials used—the proper combination of such—and lastly, a due regard to the several conveniences and arrangements of the rooms, according to the purooses of the intended building.

* These mouldings are applicable to shutters, and all panelling. The common ledged, beaded, and braced door is simply boards put together, with transverse and diagonal pieces at the back.

† Walls built with unhewn stone, or without mortar, are called *rubble walls*, which are of two kinds—coursed and uncoursed. In the former the stones are hammer-dressed or axed, each row forming a horizontal face: in the latter they are used nearly as produced from the quarry. The stones which run through the thickness of the wall are called *bond stones*. In *ashlar fronts*, great care is requisite to bind the facing with the rubble or the brick behind.

SAFETY OF LEAD PIPES PROTECTED BY TIN.—Extract of a letter from Mr. G. Chilton, dated New-York, June 23, 1834.

Dear Sir,—Observing, in a late number, a notice of Ewbank's *patent* tinned lead pipes, and having had many applications for information concerning the danger attending the use of metal pipes for conveying water, beer, cider, &c., I have been induced to subject the pipes of Ewbank to a few trials, for the purpose of ascertaining whether, from the occasional contact of acids, any deleterious solution of lead would attend their ordinary use. It is well known, that the common beer pump, with a leaden pipe, has frequently given to the liquor a dangerous impregnation, especially after remaining stagnant for a time, and the beer in a sour state. The substitution of block tin would remove the apprehension of danger, but its greater price offers a strong temptation to the use of lead. It appears to me that the lead tube lined with tin will answer the ends of cheapness, safety, and durability. I would therefore invite your attention to the following experiments, which, if you think them of any importance to the public, you may insert in your Journal.

Experiments.—Various portions of lead tube, coated, some with pure tin, and others with different alloys of tin and lead, were bent into the form of a semi-circle, and filled with vinegar of different degrees of strength. After standing, some a month, and others six weeks, with occasional disturbance, the clear solutions were tested, first with sulphate of soda, and afterwards with bi-hydro-sulphuret of ammonia. The application of the first of these tests, namely sal. soda, produced no alteration in any of the solutions, from which it must be inferred that they contained no lead.

The application of the second test produced, as was anticipated, a brown precipitate of sulphuret of tin. In the same manner, two fresh pieces of tube were filled with a strong solution of common salt, which remained in contact for some time. The solutions, when assayed with the same tests, showed that nothing but a little tin was dissolved.

It appears that in all these cases, which I regard as galvanic effects, the tin was the most oxidable metal, although, when not under the influence of polar arrangement and in the open air, lead appears to oxidate sooner than tin. It is scarcely necessary to remind you that results similar to these were obtained thirty years ago by the celebrated Professor Proust, at Madrid, who undertook for the Spanish government an extensive series of experiments on the different alloys of lead and tin, with the express view of determining whether the popular prejudices against the coating of copper vessels with an alloy of tin and lead, which is the common practice, was ill or well founded. Nothing can be more satisfactory than the conclusions he drew from his labors, namely, that as, in all his numerous experiments, neither lead nor copper were dissolved, there is little reason to fear the solution of lead from the tinning of our kitchen utensils. I may just mention here, that I am in the habit of cleaning out my soda fountain every spring with dilute muriatic acid, which uniformly dissolves the oxide of tin without touching the copper, which I am persuaded will remain as securely as the sheathing copper in Sir Humphry Davy's great experiment, and for the same reason.—[American Journal of Science and Arts.]

DISCOVERY OF SILVER ORE IN THE OURAL MOUNTAINS. — The Oural chain has been for several years well known to Europe for its rich gold and platina ores. A discovery has now been made of rich silver ore in two places. The first is seventy wersts from the foundry of Nischneitagilsk, near to the confluence of the little River Graesnoy with the Tagil, where gold also occurs; the other is twenty-two wersts from the foundry of Nischneitagilsk, on the little River Ulka.

On the Location of Railroad Curvatures; being an Investigation of all the Principal Formulas which are required for Field Operations, in laying Curves and Tangent Lines, to pass through Given Points. By J. S. VAN DE GRAAFF. [From the American Railroad Journal.]

ART. I.—When it becomes necessary for a road to pass from a right line into a curve, the former should in all cases be laid tangent to the latter. It is, however, unnecessary, in ordinary roads, to adhere to this principle with the rigor of an accurate geometrical construction; but with reference to a railroad, it should be observed with the greatest care and precision, *as well as the general selection and distribution of the various curvatures.* This is an obvious consequence of the well known law of *inertia*; for any two points being fixed, in the general direction of a route, through which it is proposed to lay a line of railroad composed of several curves and intervening tangents, the cost of construction is in most cases not the only requisite datum to fix the definite location of the intermediate points.

There are, indeed, very few varieties of ground, except in a very broken country, which will not admit of several different lines, connecting the same points, all at nearly an equal expense of construction, and all within the same *limits* of curvature. It therefore becomes an object to make such a selection of

right lines and curves, and such a distribution thereof, as will produce, *at a given expense*, the most efficient road.

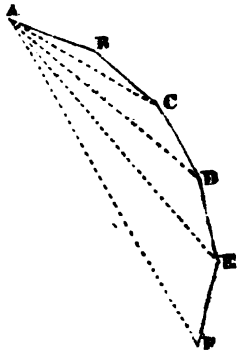
The effect of curvature, upon the *cost of transportation*, does not fall within the present subject; and the only general rules which can, therefore, be here given, as a guide for the arrangement of a line, are the following: Endeavor to open the closer curves by increasing their length, or by increasing the length of some of those which have a greater radius, or by giving some tangent line a different direction. But a sufficient dexterity in the judicious arrangement of the curvatures of a line can only be had from experience; and the principal object which is here proposed is an investigation of the various formulas which are required in facilitating the operations in the field.

2. In order to obtain results which are of commodious application in the field, it is necessary to use only circular arcs for curves; but when the situation of the ground is such as to render a continuous arc of the same curvature inapplicable to the purposes required, a curvilinear line may nevertheless be traced in such a manner as to take any desired form, in order to pass through any number of designated points, by merely connecting together a succession of circular arcs, having different *radii of curvatures*. To make a good selection in the field, for those different circular arcs, requires skill and judgment; but the only additional care to be observed in the operations of tracing such a selected line, will arise from the necessity of connecting the different arcs in such a manner as that they may have a common normal at their point of connection.

The following well-known properties of the circle exhibit the first principles which will be necessary in the subsequent inquiries.

Theo. I. The angle of deflection* between two equal and contiguous chords is measured by the arc which is subtended by either of the chords. II. If there be a tangent line, and a chord from the touching point, the angle of deflection from the tangent line into the chord is one-half of the angle of deflection between two such equal chords. III. Tangent lines from the two extremities of any arc, form equal angles with the connecting chord: each equal to one-half of the intercepted arc. IV. Any angle at the circumference, standing upon a given chord, will have a constant value for all positions of that chord upon the circumference; and this constant value is one-half of the arc subtended by the given chord. These principles are presumed to be familiar to the reader; and have been here transcribed only for the sake of convenient reference.

3. Let any number of equal straight lines, AB, BC, CD, &c., be connected together in such a manner at their extremities, that the angles BAC, CAD, DAE, &c., may be all equal to each other; it then follows from Theo. IV., Art. 2, that the points A, B, C, D, &c., will all be situated in the circumference of a circle. And this obviously suggests the common method of tracing a circular arc in the field, by means of a chain whose length is AB, or BC, or CD, &c., and an instrument for measuring the equal angles BAC, CAD, DAE, &c. It is thus easy to set as many stations in a curve as can be seen from an instrument placed at the station A. The *position* of the first chain, AB, is here taken arbitrarily, and does not effect the *curvature*.



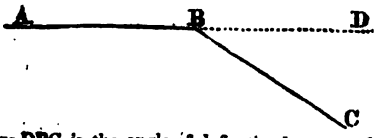
4. In using the formulas which will be deduced in the course of the present inquiry, it must be remembered that all measurements of *distance* are supposed to be made in chains, and the decimal parts of a chain. The chain will therefore be the *unity* of length, and may have any value whatever; but as this will be a constant quantity in the field, it follows, that the *curvature* of a line, traced as in the last article, can only be made variable by assuming, in succession, a different value for those equal angles BAC, CAD, DAE, &c. These equal angles will therefore be called the *modulus* of curvature, and will always be denoted by a letter T. The modulus of curvature will therefore be a constant quantity in the same curve, but variable in different curves; and any curve will be given, when its modulus of curvature is known. The letter n will be taken to denote the number of chains composing any arc which may be under consideration, and the letter D to represent the number of degrees contained in that arc. It is then obvious, from Theo. IV., Art. 2, that each chain will subtend a portion of the circumference equal to 2T; and consequently the following formula is the evident result

$$D = n \times 2T. \qquad (I.)$$

This expression gives the number of degrees which any arc contains, when the modulus of curvature and number of chains are known.

5. In tracing a circular arc of given curvature, by means of chords of more or less than one chain in length, the particular modulus of curvature corresponding to any given length of chord will be nearly proportional to the length of that chord, when that length is only a very small part of the whole circumference. For, in this case, the length of the given chord will be nearly proportional to the number of degrees

* The angle of deflection between two lines which meet in a point, is the angle contained between either line and the other line produced.



Thus DBC is the angle of deflection between the two lines AB and BC.

in the arc which it subtends, and therefore, also, by Theo. IV., Art. 2, nearly proportional to its particular modulus of curvature.

Hence T denoting the modulus of curvature for a given curve with a chain whose length is unity, then $p \times T$ will be nearly the modulus of curvature for the *same curve* when traced by means of chords whose length is p chains. This result is only approximative; but a rigorous formula will be investigated hereafter. It is evident, upon the same principles, that (I.) is rigorous only when n is an *integer* number of chains.

6. Since each chain in a curve subtends a portion of the circumference equal to double the modulus of curvature, it follows, from Theo. I., Art. 2, that the angle of deflection between any two contiguous chains will likewise be equal to double the modulus of curvature. And it thus also obviously appears, from Theo. II., Art. 2, that the angle of deflection from any chain, into a tangent line at either of its extremities, will be equal to the modulus of curvature.

7. When a given curve contains more than one chain of the same modulus of curvature, and the direction of a tangent line at any station be required, it should never be found from the direction of the first chain at that station; for small errors will arise, both in placing the instrument vertically over one of the stations, and in taking the back sight to the centre of the other, and the angular effect of these errors will obviously diminish as the two stations are more remote. In order, therefore, to obtain the direction of a tangent line at any station in a given curve, direct the instrument into a chord, embracing a number of chains in the proposed curve, denoted by n; and it then appears, from Theo. III., Art. 2, that $\frac{1}{2}D$ will express the angle of deflection from the selected chord into the required tangent line. Hence, by Art. 4, the formula required in obtaining the direction of a tangent line is,

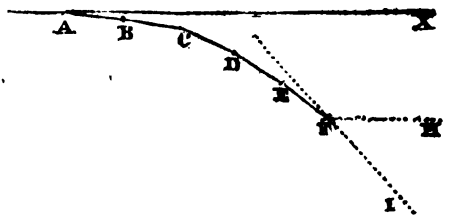
$$\frac{1}{2}D = n \times T \ . \qquad \text{(II.)}$$

8. The general method of tracing a curve in the field, having the modulus of curvature given, will appear from Art. 3; but it remains yet to show how such a curve may be laid to a given tangent line at a given point. It is obvious from Art. 6, that the required object will be attained by laying the first chain from the given point with an angle of deflection from the given tangent line equal to the modulus of curvature of the proposed curve. For then the same curve may obviously be continued from that first chain to any number of chains, by the method of Art 3.

9. It is frequently necessary to pass from one given curve into another, having a different modulus of curvature. When this case occurs, the instrument must be placed at the station where the change of curvature is to be made; and let it be directed into the *tangent line of the first given curve* at that station, agreeably to the method in Art. 7. The instrument may then be considered as adjusted, so as to be in readiness, either to lay a *continuation* of the first given curve, or to lay any other curve, from another given modulus of curvature, in such a manner as to have a common tangent with the first curve at the *point* where the two curves pass into each other; and it is sufficiently obvious that, in either of these two cases, the selected curve must be traced agreeably to the principles given in Art. 8.

When, therefore, a change of curvature occurs at any station, the angle of deflection between the two chains at that station will be equal to the *sum of the two moduli of curvatures.*

10. Let AB, BC, CD, &c. represent the successive chains by which a given curve, ABCD, &c., may be traced from its origin at the station A, in such a manner as to touch a given right line, AX, at that point. It is proposed to investigate a formula which will express the inclination of the given tangent line AX, to the nth chain in the given curve, estimating from the origin at the point A.



Take EF to represent the nth chain; and let the letter E denote the required inclination of the line EF to the given tangent line AX. The inclination of the first chain, AB, is expressed by the given modulus of curvature T, agreeably to Art. 6, or 8; and consequently, the inclination of the second chain, BC, will be expressed by T + 2T, or 3T. In like manner the inclination of the third chain, CD, is expressed by 3T + 2T, or 5T. Hence the inclinations of all the chains AB, BC, CD, &c. will obviously be expressed by T, 3T, 5T, &c. respectively. The problem is therefore evidently reduced to the following very simple inquiry, viz.: To find the value of the nth term of the series 1, 3, 5, 7, &c. But agreeably to the principles of arithmetic, this nth term will be expressed by $2n-1$. The desired formula will therefore be,

$$E = T \times \overline{2n-1}. \qquad \text{(III.)}$$

The expression (III.) will be frequently very convenient in the field when it is required to compute the magnetic bearing of any particular chain in a long curve, when the bearing of the given tangent line at the origin is known. If the country be free from metallic matter, and the instrument be in proper order for use, the magnetic bearing will always serve as a very useful check in detecting any material error which may have been inadvertently committed in the previous deflections. By way of a numerical illustration of this, let the given tangent line AX bear due North; and let the given modulus of curvature be 2°, to find the bearing of the 20th chain. Here $T = 2°$, $n = 20$; and therefore $E = 2° \times \overline{40-1} = 78°$; and if the

curve be supposed to bend to the left, then the bearing of the 20th chain is N. 78° W. If the observed course do not correspond with this result, some error has been committed in tracing the curve. This method of proof is so very simple, that it should be attended to frequently in tracing long curves, in order to avoid useless labor after some error may have been already committed. The magnetic bearing of a particular chain in a curve is also sometimes required in the field for other purposes.

11. Let ABCD, &c., represent a given curve traced as in the last article; and take EF to represent the nth chain estimated from the origin at the point A. It is proposed to find a method of directing the instrument, when placed at the station F, into a position parallel to the given tangent line AX at the origin of the curve.

Direct the instrument into a chord, through any of the back stations, as for instance the station C or D, (see fig. Art. 10,); and, from that chord, deflect into the tangent FI, at the station F, agreeably to the method given in Art. 7. Take D′ to denote the inclination of the tangent FI, to the given tangent AX at the origin of the curve, and it evidently follows, from Art. 6, that, $D' = E + T$; or, substituting for E its value from (III.), the following expression is at once obtained,

$$D' = 2nT \ . \qquad \text{(IV.)}$$

Hence, from the tangent FI, deflect an angle IFH equal to $2nT$; and the instrument will then have the required position FH.

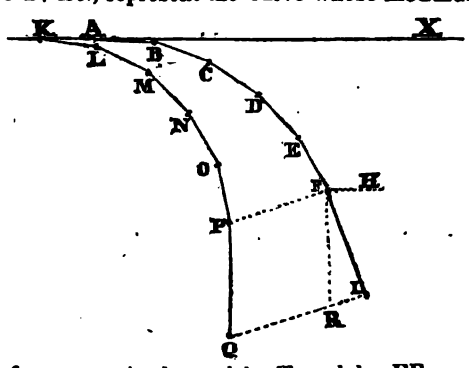
The principle which has just been explained will very frequently be highly useful in the field. For if the origin of the given curve ABCD, &c. be removed from the point A, to any other point in the tangent line AX, then the station F will be changed exactly by the same quantity, and in the same direction, upon the line FH, as will be hereafter shown.

12. Let any two curves be laid upon the same tangent line, and take T and T′ to represent the two moduli of curvatures, and let each curve pass into a tangent at the extremities of the nth and mth chain respectively. It is then proposed to determine a formula which will express the inclination of those latter tangents to each other.

Take z to denote the inclination required. From (IV.) it appears, that $2nT$, and $2mT'$, respectively, will express the inclination of each of the proposed tangents to the common tangent at the origins of the two curves; and hence the difference between the quantities $2nT$ and $2mT'$ will obviously express the value of z. The formula required is therefore the following,

$$z = 2nT - 2mT'. \qquad \text{(V.)}$$

The expression (V.) will find an application in the field in all cases where two tangents are under consideration; for in computing the rate at which any two tangents converge or diverge, their inclination to each other is, of course, the first datum required. The principles contained in (V.) and its application to different cases occurring in the field, will be more easily explained by a reference to a figure. Let A B C D, &c., represent the curve whose modulus



of curvature is denoted by T, and let EF represent the nth chain, and FI the tangent at F. In like manner let KLMN, &c., represent the curve whose modulus of curvature is denoted by T′, and let OP represent the mth chain, and PQ the tangent at P.

Draw FH parallel to KX, the common tangent at the origins of both curves; and draw, also, FR parallel to the tangent PQ. The inclination of the tangent FI, to the common tangent KX, will evidently be expressed by the angle HFI, or $2nT$; and the inclination of the tangent PQ, to the same common tangent, will in like manner be expressed by the angle HFR, or $2mT'$. Hence the angle IFR, which measures the inclination of the two tangents, FI and PQ, *to each other*, will be expressed by the quantity $2mT'—2nT$. When, therefore, the value of z in (V.) comes out *negative*, it shows that the line FR falls below the tangent FI; that is, *the two tangents in that case diverge*. When z comes out positive, the line FR will be situated above the tangent FI; that is, in such a case the two tangents PQ and FI *will converge*. It is here supposed, however, that the two curves do not intersect each other.

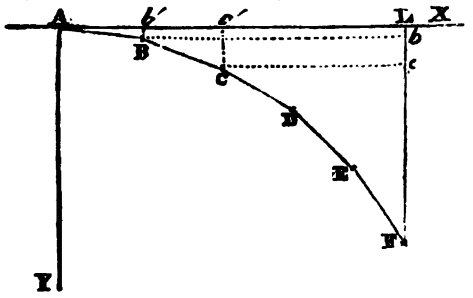
It is sufficiently obvious that the angle $2nT$ will remain the same, whatever position may be given to the origin A in the tangent line AX; and it hence evidently follows, that the distance AK, between the two origins, has no connection whatever with the inclination of the two tangents, FI and PQ, to each other. The distance AK will, however, have an effect upon the line PF, which expresses the distance between the extremities of the two curves. Supposing the distance AK, and the moduli of curvatures, with the number of chains, n and m, contained in each curve, to be all given, the line PF may be computed by methods which will be hereafter explained; and then the angle IFR, which measures the inclination of the two tangents, FI and PQ, to each other, being known from (V.), it will be easy to compute the situations of any proposed points, in those two tangents, which may come under consideration in the field, by the common methods of plane trigonometry.

When the distance PF is very small in comparison with the length of the tangents FI or PQ, and when these tangents are but little in-

clined to each other, every necessary calculation in the field may be made by means of very simple approximative methods. All this will be fully explained in the subsequent articles.

13. Let AB, BC, CD, &c. represent the successive chains by which a given curve ABCD, &c., may be traced from its origin at the station A, in such a manner as to touch a given right line, AX, at that station; and let EF represent the nth chain, counted from the origin at A.

Taking AX, and AY, for a system of rectangular co-ordinate axes, it is proposed to investigate formulas which will express the values of the co-ordinates AL and LF, of the station at F.



Put $x = AL$, and $y = LF$. The inclination of the first chain AB, to the axis of x, is found by Art. 10 to be $= T$; and therefore the projections of AB upon the co-ordinate axes will be, $Ab' = AB \cdot \text{Cos. } T$, and $Lb = AB \cdot \text{Sin. } T$. But as all lines are supposed to be measured in chains, it follows that the projections of AB upon the co-ordinate axes are, $Ab' = \text{Cos. } T$, and $Lb = \text{Sin. } T$. Again, by Art. 10, the inclination of the second chain BC to the axis of x is $= 3T$, and consequently the projections of BC upon the co-ordinate axes, are $b'c' = \text{Cos. } 3T$, and $bc = \text{Sin. } 3T$.

In like manner let each of the other chains be projected upon the co-ordinate axes; and then taking the sums of those projections, the following equations will obviously be the result,

$$x = \text{Cos. } T + \text{Cos. } 3T + \text{Cos. } 5T + \ldots\ldots$$
$$\text{Cos. } \{T \cdot \overline{2n-1}\}.$$

$$y = \text{Sin. } T + \text{Sin. } 3T + \text{Sin. } 5T + \ldots\ldots$$
$$\text{Sin. } \{T \cdot \overline{2n-1}\}.$$

The reason for writing the last term, in each of these two series, as the nth term, requires no explanation; and the *sum* of n terms of each series being taken agreeably to the known principles of analytical trigonometry, the following formulas will be the result,

$$x = \frac{\text{Sin. } 2nT}{2 \text{ Sin. } T}$$

$$y = \frac{\text{Sin. }^2 nT}{\text{Sin. } T}. \qquad \text{(VI.)}$$

The form in which the expressions (VI.) appear is that most convenient for logarithmic computations; and it is also a form which will be required hereafter for other purposes. But for use in the field, with a table of natural sines and cosines, the expression for the value of y may have a better form. Thus, agreeably to the principles of analytical trigonometry, $2 \text{ Sin. }^2 nT = 1 - \text{Cos. } 2nT$; and consequently the expressions (VI.) become,

$$x = \frac{\text{Sin. } 2nT}{2 \text{ Sin } T}$$

$$y = \frac{1 - \text{Cos. } 2nT}{2 \text{ Sin } T}. \qquad \text{(VII.)}$$

Such are the formulas which it was proposed to investigate. For an example in figures, let the modulus of curvature be 1°, and suppose it were required to find the values of AL and LF, corresponding with the extremity of the 40th chain. In this case, then, $2nT = 80°$; and by the table of natural sines and cosines, at the end of this volume, I find Sin. 80° = .98481, Cos. 80° = .17365, and Sin. 1° = .01745; hence,

$$x = \frac{.98481}{.03490} = 28.214 \text{ chains; and}$$

$$y = \frac{1 - .17365}{.03490} = \frac{.82635}{.0349} = 23.675 \text{ chains.}$$

If, therefore, the chain used in tracing the curve be 100 feet in length, then AL = 2821 feet, and LF = 2367 feet.

Packet Waggons.

To the Editor, &c.

For the conveyance of packets, or small packages, from one part of our country to another, the following system may be adopted. A store is selected in New-York city as a receiving, forwarding, and distributing office. A package is deposited there, directed to some town in the United States, as Haverhill, Mass. From New-York it is then carried with other packets to Boston, to a receiving office there. Here packets are distributed to different parts of the country; and the packet to Haverhill is carried to an office there. If it is a regular periodical publication, the person to whom it is sent knows when to call for it; or, if he has directed a parcel to be transmitted to him, he expects it of course; but, if it is sent to him by a friend, a letter by mail announces the coming package.

Respecting the expediency of establishing such a system of packet waggons, the following remarks may be made.

There is now a great amount of transportation over the country. I have seen it stated that one mail has carried from New-York 3,000 pounds of letters and packets. It has been remarked of the mails from Boston that they are excessively loaded. But the stages do not convey all the periodicals that circulate over the country; for many go by water, and many are distributed by private opportunities. Add together all the literature that is dispersed over the country, critical, scientific, fictitious, classical, and religious—weekly, monthly, quarterly, annual, and occasional—and you have a vast amount of paper to be conveyed.

But it may be further observed that the amount of transportation increases. The lite-

rature of the present day is of a more periodical character than it has been, and periodical publications are many of them of more solid worth than formerly. Books are made cheaper, and they are printed in greater abundance, and the reading population is vastly increased, and there is therefore a much increased transportation of printed paper. The transportation increases also by the influence of great printing establishments. By having a wide circulation for their books, they can print them in great numbers, and by superior presses, and with steam power; and thus they can afford them cheap, and very distant readers are advantageously supplied.

Another fact may be attended to. Transportation by waggons may be much cheaper than by mail stages. It costs four times as much to transport a load at the rate of eight miles an hour, as to transport it at the rate of two miles an hour. Packages might easily be carried 33 miles a day at one-third the expense now attending the conveyance by mail coaches; and for most purposes this would be sufficiently rapid. From New-York, by steam and wind, packages might be carried cheaply and expeditiously to the North and South, to Bangor, Portland, Boston, and New-Haven—to Norfolk, Charleston, and Savannah. From some of these larger depots, lines of conveyance may be established to places of inferior importance, so that every family might find within ten miles, and most families within two or three miles, a place of deposit, where parcels might reach them from distant sections of the Union.

It may again be noticed that the course of trade now requires more transportation. Business is conducted by larger establishments, and the public is benefitted by it. Said Mr. S., a close, calculating farmer, "You may now buy a handsome, iron-hooped, painted pail cheaper than neighbor A. sells one of his clumsy ones." Though neighbor A. loses his business of making pails, the town is on the whole greatly benefitted, and he can turn his hand to some other profitable business; and we can send 100 miles and get our pails cheaper than a cooper at our next door can afford to sell them. This is a specimen of the advantages arising from good means of communication. It was stated not long since in England, that fine goods, parcels of value, and all light articles, which needed to be conveyed with speed and certainty, were sent at great expense by coaches. In many cases light and small articles would be sent by a regular line of conveyance, though more expensive than by the present ordinary routes of trade. The means of communication that now exist have scattered friends and relatives widely from each other, and a regular system of transportation would accommodate them, and be improved by them.

The system recommended now exists to some extent. From one seaport to another bundles are carried by packets, and distributed according to the direction on them; and in some cities, baggage waggons carry goods into the interior towns. This system thus commenced may be made more complete. A deposit store is selected in New-York for Boston or Portland. A packet or steamboat takes the packages left in them, and sends them on in the line with which it is connected, to Boston, Portland, or Bangor, according to their direction. In Boston, if directed to a town near there, they are placed in the deposit store, and the packet waggon that passes to or through that town forwards them; and here they reach their destination; and from the deposit store here they are taken by the person to whom they are sent. I live in the country, about 30 miles from a seaport. I have articles sent me 100 miles by water. The packet master takes these articles to the seaport nearest me, and there the merchant with whom he stores them pays the freight, and the one who brings them up to me pays the freight to the merchant, and I pay the whole cost of transportation to him; both what he paid and what he is to receive for conveying the articles by land.

The establishment of a general system of transportation will help the publishers of books and periodicals, and it will help families.

It will help families. If they wish for a book from their nearest market town, there is a regular line to convey it. If they wish for a book or periodical from a distant city, they can obtain it. They write to the bookseller: he places it in the deposit store, and it is forwarded. Thus families in remote towns have easy access to the literature of the day. If a benevolent society wish to procure a quantity of tracts, or Sabbath school books, they have only to send to a remote establishment, and a bundle is placed in the deposit store, and it goes on to their direction like a letter in the mail.

Such a system of transportation again will help publishers. Postage is one impediment to the circulation of periodicals. It often amounts to one quarter, to one half, or even three quarters the original cost of the periodical. This operates like a heavy duty. Remove this duty, and the circulation of periodicals will be greatly increased, and books in general will be purchased more freely, and printers and booksellers will find increased encouragement.

But to establish such a system a clause in the post office law must be repealed, which enacts "that no person, other than the post-master-general, or his authorized agents, shall set up any foot or horse post, for the conveyance of letters and packets upon any post road which is or may be established as such by law." But if it is seen that the public interest requires the repeal of this clause, Congress can repeal it; and printers, publishers, booksellers, and buyers, can petition for this object.

PUBLICOLA.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum *in advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING AUGUST 23, 1834. [NUMBER 2.

"It is freedom of communication that prevents evil; let men communicate their sentiments to one another, it is like fire scattered on the ground, or like gunpowder scattered on the surface of the earth: it communicates, but the explosion is not heard; keep it under constraint, it is like gunpowder compressed, and like subterraneous fire, whose agitation is unseen until it bursts into an earthquake. Let argument be opposed by argument, and reason opposed to reason."—ERSKINE.

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from page 44.)

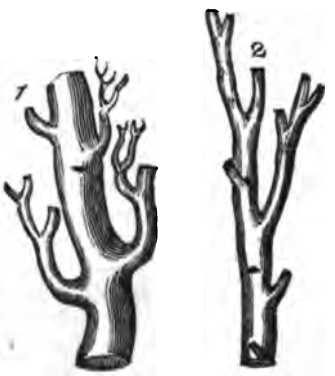
With these facts before us, we turn with interest to what the anatomist too often contemplates with unconcern: we mean the different curves in the branching of the arteries and veins; for by this law of hydraulics the junction of the branches and trunks of the arteries and veins ought to be different, as the one vessel, the artery, carries the blood out from the heart, that is, from trunk to branch; and the other vessel, the vein, carries it in the opposite direction towards the heart, or from branch to trunk.

And, in matter of fact, their branchings are very different, and characteristic of the vessels. We have heard a teacher of anatomy express himself in this manner: "The arteries are active and powerful vessels, which carry the arterial blood out from the heart; and they receive the forcible impetus of the heart. When they are wounded, the man bleeds to death; therefore, nature conveys these vessels into the recesses of the body, taking advantage of every protecting bone—conveying them so that the bones and the muscles protect them. There are no irregularities in their course, and their branches go off at a determined angle, and never irregular; but the veins," he would continue, "are vessels of less importance: they convey the blood back to the heart, with a languid motion, and if they are wounded the blood flows with so diminished a force that you can stop it with the pressure of your finger; accordingly, nature is more negligent of them: they run in all their courses irregularly—some deep, some superficially; and their branches join their trunks with awkward irregular curves and elbows."

This is in good feeling and is in part true; but it contains somewhat of the error which runs through most anatomical discourses, of supposing things are irregular, as if the objects in view were inartificially and imperfectly attained. From inattention to the hydraulic principle, he seems not to have considered that the connection of trunk and branch must vary according to the direction of the stream—that the direction of the branch, which is adapted to lead the stream from the trunk into the branch, must be altered when the design is to convey the fluid from the branch into the trunk.

The reader will now understand, that the branch of the artery (fig. 18, No. 1,) gently diverges from the direction of the stream,

Fig. 18.



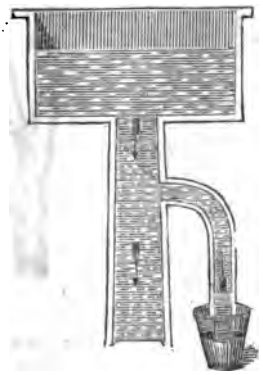
while the branch of the vein, in No. 2, enters abruptly and at right angles. We may illustrate this, by observing, that if we could suppose the vein substituted for the artery, and the artery for the vein—if the vein carried the blood outwards, instead of towards the heart, and the artery conveyed the blood back to the heart,—the blood could not run in the circle; it would be retarded, and congestion would take place, somewhere in its course.

We have seen by the demonstration above, that if the veins of the human body were rigid tubes, and if a hole were made in their sides, air might be drawn in instead of the

blood flowing out. This is a matter of vital consequence, for if a very little air be blown into the veins of an animal it dies in an instant, and there is no suffering, nor struggle, nor any stage of transition, so immediately does the stillness of death take possession of every part of the frame.

In conversation with Napoleon's celebrated surgeon, Baron Larrey, on the case of a young man wounded in the neck, he said he had no hesitation in declaring the cause of death to be air drawn in by the veins of the neck, and he quoted instances occurring at the battle of Wagram. These circumstances greatly increase the interest of an experiment made by Dr. Barry, who found that on introducing a tube into the vein of the neck, and placing the other end of the tube in a vessel of water, the water rose during inspiration. The difficulty of explaining this arises from those veins being membraneous tubes, and consequently compressible; but in the act of inspiration, not only are the ribs and breast bone raised, but the muscles of the neck attached to the collar bone rise from the veins of the neck. By this means, instead of suffering the compression of the incumbent parts, the atmospheric pressure is taken off the veins; they are brought to the condition of rigid tubes; and the principles of hydraulics explain the rest. Thus, fig. 19 is a reservoir emptied by a perpendicu-

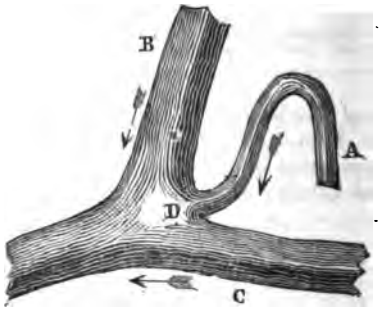
Fig. 19.



lar tube, into which a smaller tube is inserted. The water descending by the larger tube will draw the water up through the lesser tube, so as to empty the glass, in which its lower end is immersed.

We shall here give an example of the manner in which the trunk of the absorbent system joins the venous system, a circumstance which has not escaped the notice of anatomists. The absorbing or lymphatic system consists of a set of vessels different from arteries and veins, which imbibe by a sort of capillary attraction at their extremities, and convey their fluids towards the centre, without any such impulse as the proper blood vessels receive from the heart. The stream in the trunk of this vessel has no force to impel it into the stream of blood in the veins; it enters, therefore, in this manner.

Fig. 20.



A is the trunk of this system, called the thoracic duct; B is the great jugular vein descending from the head; and C, the great vein coming from the arm. These veins join at an angle, and the streams from them, in the direction of the arrows, leave a point between them at D, where there is no pressure. If two tubes enter into a larger tube obliquely, and the water be flowing from the lesser tubes into the greater one, and if a hole be bored at the angle of their union, the water will not escape at that hole. Therefore, the fluid from the thoracic tube A meets with no impediment at the point D; when entered, we have seen, by a former diagram, how the attraction of the more forcible stream will draw the contiguous fluid after it. By this contrivance, if we may use the word, the fluid in the absorbing system finds access to the red blood, and is carried into the heart. We might continue this subject by considering the influence of respiration on the circulation; but we shall pursue the inquiry into the hydraulic principles, as applicable to the circulation, independently of pneumatics.

The law of inertia, which is of easy comprehension as it regards solids, is also applicable to fluids; it is easier to keep a column of water in a pipe in motion than to put it into motion from a state of rest.

In a forcing pump, when after each movement of the piston the columns of water become stationary, power is unnecessarily lost by bringing the column of water, which is in this state of rest, again into motion; but if a second blow of the engine be given to the column of water whilst it is yet moving,

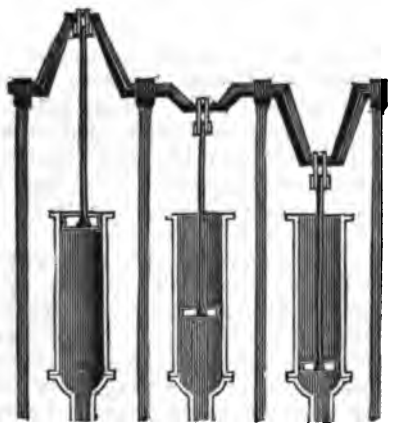
it is found to be more easily pressed forward, and no part of the force is lost in urging it from a state of rest into motion. This is evinced in the contrivances of the engineer. He employs two forcing pumps instead of one, and he so applies his lever as to operate alternately on the one and the other; to the end that the water in the pipe may be kept in uninterrupted motion. Let us apply this principle to the circulation of the blood.

If the heart were the only power forcing on the blood, there would be a cessation of motion after each pulse of the heart, and therefore a great part of its power would be lost. This explains why there is a power in the artery as well as in the heart. The artery being muscular seconds the operations of the heart; its muscularity, and the muscularity of the heart, are powers exercised alternately, and which, acting like the double stroke of the engine, permit no interval to the motion of the column of blood. If the heart had to act upon a column of blood at rest, not only much of its force would be unnecessarily exhausted, but it would be excited to propel an inert body, and a dangerous shock would arise from the resistance.

If we pursue this subject, and inquire what is essential to such a hydraulic machine as we are contemplating, we shall perceive that the engineer meets with a difficulty in adjusting the powers of his two pumps, and finds an interval, or pause, in the application of their forces.

To obviate this, he makes three cylinders, the pistons of which are moved by a crank,

Fig. 21.

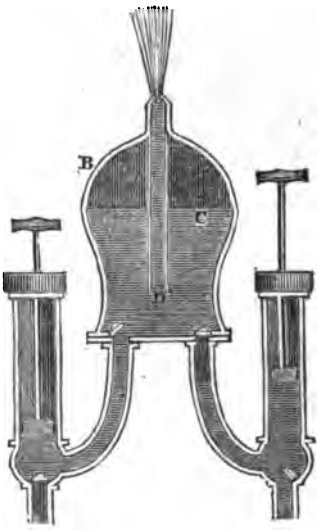


which so orders the descent of the pistons as to fill up this interval, so that one of the pistons shall be always descending; and these pumps propelling the water into a common tube, there is no interval to the motion of the fluid through it.

By this example we are led to look for something corresponding in the machinery of the circulation. We find no third active power, however; yet we find a quality in the blood vessels which answers the purpose much better. But to comprehend this, we must observe that the engineer has a more admirable contrivance than this of a third pump to adjust the action of the other two.

He confines a body of air, which, by its elasticity, performs the office. The pipes

Fig. 22.



of two forcing pumps are carried into the reservoir, B; they convey the water up to C, by which time the air is compressed, and its elasticity thereby increased. That elasticity is exerted without interval, and, acting on the water, C, propels it into the tube, D, uninterruptedly.

Just such an elastic property is possessed by the arteries. The great artery which goes out from the heart, as we have had repeated occasion to observe, makes a sweeping curve; it is capacious, and is the most perfectly elastic of any thing in nature. Here then we have the three powers which the engineer finds necessary to employ. We have the alternate action of the heart and the artery, and we have an elasticity, which, though passive, is essential, both to the uniform flow of the blood, by filling up the interval in the action of the two powers, and to the safety of the engine itself; for without this elasticity, there would be such a jar as must speedily destroy the mechanism.*

* But does the blood flow uniformly? Not precisely so in the arteries, since the stroke of the heart is more powerful,

There is nothing more admirable than the influence of this elastic power; it is greatest in the coats of the artery near the heart, weaker in the coats of that artery as it recedes from the heart: this very evidently declares its use, but we shall take a more sufficient proof, although an unhappy one.

As life advances, the arterial system loses much of its elasticity, and becomes rigid. This is so common an occurrence that we can no more call it a disease than the stiffened joints of an old man: it is the forerunner or the accompaniment of the decline of life. But this sometimes takes place too early in life, and to an extreme degree; and from its effects we must call it morbid, for it not unfrequently happens that the muscular power of the heart being still entire and vigorous, the arteries can no longer sustain it. They are not now endowed with that power which, yielding to the heart's action, resists, and recoils the more it yields,—which takes off all sudden shock, and which in yielding wastes no power, since on its recoil it gives as much force to the acceleration of the blood as was lost of the heart's action. The artery then, becoming rigid, yields indeed to the heart's impulse, but has no recoil. It is permanently dilated or enlarged. It is now called aneurismal. A stronger impulse from the heart, excited by inordinate action or passion, chips and bursts the now rigid coats of the artery. If the breach be sudden, it is death; if it be gradual, a pouch forms—a true aneurism. And now we have the proof we require: for this bag coming to press upon the solid bones, they are destroyed. That action of the heart which was so lightly and so easily borne whilst the vessels were elastic, now beating upon a solid structure, in a short time destroys it. Thus we are led to a more accurate knowledge of the fine adjustment of the active and resisting properties in the circulating vessels during youth and health, by what takes place on a very slight derangement of those powers.

Sailing against the Wind.

To the Editor of the Mechanics' Magazine:

Sir,—I beg leave to offer a few remarks on the quotation in the last number of the Mechanics' Magazine from a London paper, respecting sailing against the wind.

There is no axiom, perhaps, in the science of mechanics, better established than that action and re-action are equal. Now, "let a ship be provided with sails like those of a windmill, and let the power thus acquired work a paddle wheel"—let the wheel operate in a contrary direction from that of the wind and sails; then the power of the wind against the sails would be exactly equal to that of the paddles against the water, *minus* the friction.

Suppose the resistance from friction to be equal to one fourth of the power; and suppose the wind to act on the sails with a power which would carry the ship from north to south 8 miles an hour; then the power of the paddles to carry the ship north would be 8—2 = 6 miles an hour; so that while she went 6 miles to the south, she would go 8 miles to the north—that is, two miles per hour *astern*. This would be a useful invention indeed!! much like some other improvements of modern date.

Simplex.

Twin-Boats—Archimedes in reply to Mr. Chas. Harris.

To the Editor of the Mechanics' Magazine:

Sir,—I hope you will not deny me the privilege of using the Magazine to express to Mr. Charles Harris assurances of my gratitude as well as extreme gratification, for his having condescended to notice so unworthy an individual, especially for having thus publicly acknowledged that he believed, or at least that he once believed, that I was *honest* and *generous*, though rather simple. But all this is nothing to the pride I feel in having afforded (by my simplicities no doubt) amusement—yes, real amusement, to a man distinguished by so much ingenuity and erudition.

But great characters sometimes make mistakes; and I must beg leave before the present inflation of my vanity subsides, to hint, with great deference, that even Mr. Harris himself has made some little mistakes in quoting my language. A passage in his second communication reads thus: "He says," (that is, I, Archimedes, says,) "that the average gain resulting from the swell was five miles per hour." Now, some miraculous optical delusions must have misled the sagacity of Mr. Harris, for there was not in my communication one word about *five miles* an hour, nor any average gain whatever, nor even the word average. I only stated that she gained from 4 to 6 miles per hour—that is, supplying the ellipsis, from 4 miles *per hour* to 6 miles per hour. From this H. calculated, with amazing precision, that "her improved speed must have been

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or rather more concentrated, than that of the arteries. During the contraction of the ventricle of the heart, the artery is dilated, but it is never emptied; and the flow of the blood forwards in the course of the circulation is not for an instant interrupted.

exactly 55 miles per hour;" or, to show his great clemency, he condescended to get the boat out of difficulty by a more favorable calculation, allowing that from four to six meant only a gain of 30 per cent., and that she only went 15 miles per hour. But still not satisfied, like the man with the monkey's tail, he set the gain, (from 4 to 6,) at 100 per cent., and then, strange to tell, the boat only went 10 miles per hour.

In his last number, with the help of the boy in the counting room, and after conjuring up also the shade of Archimedes of Syracuse to help him, he has manufactured a whole family of per cents., all out of a gain from 4 to 6.

His arithmetic, then, stands thus: From 4 to 6, that is, the difference between 4 and 6, or the distance between the 4 mile stone and the 6 mile stone is, (in the first case,) just 55 miles.

In the second case, the same difference is equal to 50 per cent., equal to 15; in the third case, the same difference is equal to 100 per cent., equal to 10.

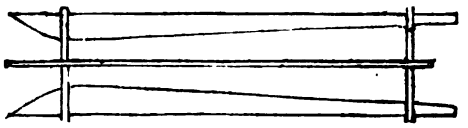
Had I been aware of the surprising talents of Mr. H., I certainly would not have exposed myself to the liability of any controversy with him. I certainly did not know that it was necessary to have a collision between Neptune and Æolus to admit a boat 35 feet long to run up the narrow river from New-London to Norwich. I only stated what persons of high respectability, now living at New-London, at least believe they saw.

To conclude, I most earnestly implore the pardon of Mr. H. for supposing that he could for a moment so far descend from the sublime technicality of naval architecture, to the vulgar vernacular tongue, as to admit that "finery" was a derivative of fine. And to prevent me from being exposed to vulgar eyes, completely overcome and subdued, as I consider myself, by the talents of Mr. H., I must beg of him, if he condescends to notice me again, to write in Latin and French, with a little intermixture perhaps of Greek and Hebrew, as, by the shade of my old namesake, he will probably be much better understood in the two last than in English, and I can get a minister to translate them for me with very little trouble.

ARCHIMEDES.

Twin-Passage Boat for Canals. [From the London Mechanics' Magazine.]

SIR,—It occurred to me when I was writing the concluding paragraph of my last letter to you, that twin passage-boats having the form shown in the annexed sketch, (which



is a top view,) would send no waves towards the banks, and might be used to advantage on canals that had no stone facing along the sides. The two outside surfaces of the boats are straight and parallel in the direction of their length, but may be curved like any other boat, from the top edge downwards, and the two interior sides must have the gig-shape as nearly as possible. The two cross-pieces connect the boats, and the tow-line is fixed to the part running up the centre. Any wave that is formed between the boats will settle at the stern, and act in the same way as the wave in the case of the Paisley canal passage-boats; and the parallel outside surfaces of the boats can raise no wave. I made a model five feet long, with the other dimensions in proportion, to try its effect, and when it was drawn through the water at the best velocity, the water all around was *perfectly* smooth, although there was a large wave formed between the boats. The wave commenced a little behind the bow, and it was level with the surface of the canal before it reached the stern; if the curved sides of the boats had been out, this wave would have been driven to the banks of the canal.

As twin boats are not likely to upset, they may be built very narrow, and not take up much room in the breadth of the canal, if their draft of water is increased. Part of the deck that holds the boats together, may be formed into seats, and all the passengers may sit with their feet down into the boats, and their faces towards the banks of the canal. The centre part of the deck may be used for walking upon, as the passengers, when standing on it, will be high enough to see over the awnings that cover the cabins. At places where the deck, for the sake of binding the boats more firmly together, must stretch from outside to outside, doors may be left from the deck to the cabins. As no waves *leave* a boat of this sort, it certainly must take less power to work it, on which account I think the principle may be applied to little sailing craft, such as pleasure boats. The waves that are formed by the *paddle* of a twin steamboat might be got quit of by forming the stern properly. In my model, the outsides were plain and parallel in the up and down, as well as in the length direction. I am, sir, yours truly,

JAMES WHITELAW

Glasgow, April 18, 1834.

Improved Method of Sheathing the Bottoms of Vessels.

To the Editor of the Mechanics' Magazine:

Sir,—Having in a late communication described an apparatus for raising vessels for the purpose of repair, I shall now propose an improved method of sheathing the bottoms of vessels, as follows: Long plates of copper, or other metal, are cut to a breadth and shape nearly corresponding with those of the planks over which the sheathing is to be laid; and these plates are so placed on the planks that the edges of each plate shall lie between the seams of the planks. Each plate is first tacked to the bottom with small tacks or nails, merely sufficient to sustain it, till two or more plates are placed side by side, the edges of each two plates being nearly one fourth of an inch apart; then a flat rod of copper or brass, about five eighths of an inch wide, and one eighth of an inch thick, having counter-sunk screw holes through it at every two or three inches of its length, is placed over the seam formed by the edges of each two plates, and is fastened with wood screws, or nails with heads similar to those of wood screws, that when driven the heads may be even with the surface of the metallic rod. The plates and rods should be as long as the vessel to which they are applied; but when this is not practicable, the ends of each piece must be chamfered so that the end of one piece may extend a little over that of another, without occasioning any projection or unevenness in the surface. The principal object of the improvement is to facilitate the speed of vessels, particularly steamboats. For this purpose, plates of an alloy, composed of tin and lead, equal quantities, are decidedly preferable to those of copper.

I claim as original the method of fastening long plates of sheathing by means of rods, as above described.

R. Porter.

Billerica, Aug. 12, 1834.

Remedy for Dry Rot.—The London Literary Gazette, of June 14, contains a sketch of a lecture upon Dry Rot, delivered by Mr. Faraday at the Royal Institution, from which we learn that a complete remedy has been discovered by a Mr. Kyan, who submitted his proposition to the Lords of the Admiralty, who have caused it to be proved and have advised him to take out a patent for it. The process is as follows: The timber is immersed in a solution of the corrosive sublimate, which is pumped into a tank, in which the timber is held down by a transverse beam, so as to prevent its floating, and after submersion for a week the operation is completed.

It has already been adopted with the timber used in the National Gallery, the new works at the British Museum, the warehouses of the East India Company, by various churches and other public buildings; and many engineers connected with the Liverpool, Manchester, Stanhope, Tyne, and Wear railways, are using timber thus prepared, in lieu of stone sleepers. It is also extensively introduced in the ship yards of England, and many gentlemen have adopted it in their domestic architecture.—[Nat. Gaz.]

Thirst for Knowledge.—The Rev. Mr. Beaumont made the following statement in an address to the meeting at the last anniversary of the London Sunday School Union.

A number of children possessed the spirit of knowledge to which he had alluded, but they had no building in which to assemble, and no one to instruct them, but they nevertheless learned to read and write. What was the place in which they assembled? A grave-yard! What were their copies? The short and simple annals of the poor. What were their materials for learning to write? The mould scattered around the graves. By those simple means they learned to read and write. The meeting was perfectly aware how very prevalent knowledge was in Scotland, but he once heard one of the principals of the University give an interesting account of an occurrence which took place in his own parish. In one of the glens there was but one parochial school, and that was situated at its extremity, in consequence of which the children living at the other extremity could not attend. The inhabitants were too poor to pay for a schoolmaster, but they adopted the expedient of selecting the finest boy in the glen; a collection was made, he was sent to the Lowlands that he might there be instructed, and afterwards return to the glen and teach all the rest of the lads. He taught the children by day, and the adults in the evening; and so the stream of knowledge was set flowing all over the glen. He had heard their reverend brother from Jamaica state, that children in the West Indies had been made the honored instruments of teaching their parents. That was not the order of nature, but an order that the God of nature and of grace frequently sanctioned and blessed, and which had been going on, not only in Jamaica, but in the East Indies, and in various parts of Britain. They were told that the dew which refreshed the earth, and

fructified it, descended; but there were some who insisted that it rose out of the earth, and the question was not yet settled. He did not care which way knowledge came, provided it did come. Let it come every way, and the faster the better.

NEW COMET.—Professor Schumacher, Astronomer Royal of Denmark, announces in his "Astronomiche Nachrichten," of the 7th inst. the discovery of a new comet on the 8th ult., by Professor Gambart, of the Marseilles Observatory. Although it disappeared on the 13th, and from the state of the weather, and temporary imperfection of his micrometer, his observations were interrupted and imperfect, Prof. Gambart assigns its place on the 10th at 16 h. 32 m. 45 s. of sidereal time, to 20 h. 9 m. 7 s. of right ascension, and 22° 33′ of south declination. When first seen, it was near the horizon, having a nebulous appearance, and situated in the constellation Sagittarius, very near the nebula 2064 of Sir John Herschel. The comet was of a pale light color, of a very round form, and with a diameter of about four or five minutes.—[The Athenæum, London, May 17, 1834.]

DISCOVERY OF A MUSCLE IN THE EYE OF FISHES.—Sir: I beg leave to announce to you the discovery of a muscle in the eyes of fishes, solving the problem of the accommodation of their eyes to distances in a more satisfactory way than by a greater or less degree of convexity of the cornea. The muscle is triangular, apparently attached to a nerve at one extremity. Another extremity is attached to the capsule of the lens at its axis. The third passes through a loop in the iris, and is attached to the vitreous humor. The lens is drawn backwards, when the portion attached to it contracts. When the portion that passes through the loop is called into action, the vitreous humor is pulled forwards, pushing the lens before it. This structure exists in the streaked bass, the sheep-head, the blue fish, the sea bass, and the poigee,—the only fishes in which I have had an opportunity of looking for it. If it be not too late, please to announce this discovery, which I believe to be new.—[Am. Jour. of Science and Arts.]

IMPORTANCE OF PERSEVERANCE.—"The great art to learn much," says Locke, "is to undertake a little at a time." Dr. Johnson has very forcibly observed that "all the performances of human art, at which we look with praise or wonder, are instances of the resistless force of perseverance; it is by this that the quarry becomes a pyramid, and that distant countries are united by canals. If a man were to compare the effect of a single stroke of the pick-axe, or of one impression of a spade, with the general design and last result, he would be overwhelmed with a sense of their disproportion; yet those petty operations, incessantly continued, in time surmount the greatest difficulties, and mountains are levelled and oceans bounded by the slender force of human beings. It is therefore of the utmost importance that those who have any intention of deviating from the beaten roads of life, and acquiring a reputation superior to names hourly swept away by time among the refuse of fame, should add to their reason and their spirit *the power of persisting in their purposes*; acquire the art of sapping what they cannot batter, and the habit of vanquishing obstinate resistance by obstinate attacks."

Report of the Managers of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, in relation to Weights and Measures. Presented in compliance with a Resolution of the House of Representatives. [From the Journal of the Franklin Institute.]

To the Hon. JAMES FINDLAY, Secretary of the Commonwealth of Pennsylvania.

The Managers of the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, respectfully present to the Secretary of the Commonwealth their report in relation to the subject referred to them by the direction of the House of Representatives. At the stated meeting of the Managers next subsequent to the receipt of the communication of the Secretary of the Commonwealth, dated May 29th, 1833, a committee was appointed to consider the subject, and to report to the Managers of the Institute. Their report, which has been unanimously adopted, is now respectfully submitted. It is believed that no more time has been consumed by the committee than was required by a careful investigation of the subject intrusted to them, and the Managers hope that the delay of this report beyond the time of meeting of the Legislature will be attributed to the necessity of the case.

ALEXANDER FERGUSON, Chairman.
WM. HAMILTON, Actuary.

Report in relation to Weights and Measures in the Commonwealth of Pennsylvania. Adopted by the Managers of the Franklin Institute, January 25, 1834.

The Committee of the Franklin Institute, appointed by the Board of Managers to consider the subject of weights and measures, referred to them by direction of the House of Representatives of the Commonwealth, respectfully report:

That since the date of their appointment, in June last, they have given to the subject

the attention which its importance so well deserved. In order to have before them, in a condensed form, the facts relating to the practical bearing as well as to the theory of the matters of inquiry, the Committee requested from three of its members reports upon the systems of weights and measures, of England, and of France, and upon the state of the question in our own country. The reports contained in the appendix, herewith presented, resulted from this request. In the first of these is given a description of the French metrical system, and of the scientific operations required in its establishment; in the second, a brief history of the weights and measures of England, with the method of connecting the recent and reformed system with a scientific basis; and in the third, an abstract of the reports upon weights and measures made to the Congress of the United States, and to the State Legislatures of Pennsylvania and New-York. An examination of these reports will show from how many points our subject has been viewed, and in what varied lights, and how little novelty can be expected in any view which at this time may be submitted. This circumstance will perhaps be found of important practical benefit, for a desire to present what is novel may have led to much of the inapplicable speculative inquiry with which the subject is encumbered.

The Committee think that they may assume that the House of Representatives of the Commonwealth, in referring the bill relating "to weights and measures and to admeasurement" to the Managers of the Franklin Institute, did not intend to confine their report exclusively to the consideration of that bill, but rather that it should form the basis of their investigations.

With this view of their duties, the Committee would propose to consider the subject under two suppositions: the first, that the Legislature of Pennsylvania shall determine, or have determined, to legislate in relation to a system of weights and measures for this Commonwealth, independently of other states; secondly, that a combined action by the several states, or by the Congress of the United States, may be admissible.

In legislating upon any matter which in its varied ramifications affects almost every business in which men engage, there cannot be too much caution. Usages have grown up in all trades, which have become a part of those trades which require a portion of an apprenticeship to learn, in contravening or changing which, by law, the interests of the citizen, if not his rights, are infringed. Hence the necessity of entering thoroughly into details which can only be supplied by the members of each art, or trade, from their own knowledge of their own wants, and which should properly vary with the progress of that art; or of leaving such details to adjust themselves, upon the basis of careful legislation upon general principles.

A system of weights and measures, which aims at furnishing such general principles, should establish the standard of linear measure, and fix the relation of the standard of capacity measures to that of the linear measure; should provide for procuring, preserving, and distributing positive standards of measure and of wieghts, and should refer the entire system to natural invariable standards, by which its permanence might be secured. It should be accompanied by a supplementary law less fixed in its character, which should state the principal denominations of the several measures and of the weights, and their relation to each other and to the standards.

The system may contemplate an entire change in the standards and in the denominations; or it may aim at providing standards in conformity with those in most common use, and by which the accuracy of existing standards may be at all times tested, and at improving existing denominations.

The case of an entire change is presented by the French metrical system, where throwing aside, in their measures, the denominations of foot and toise, they adopted a new denomination, the metre corresponding to a new length, the ten millionth part of a quadrant of a terrestrial meridian. The present English system is in part of the second kind; leaving to usage to establish the denominations, it aims at providing positive standards of authority, and of perpetuating them by their comparison with invariable standards furnished by nature. The inability of the first system to contend against usage, is to be found in the establishment by law in France of a metrical foot, one-third of a metre in length, of a metrical pound half the kilogramme of the new system in weight. Had one currency been in use throughout our infant country when the present currency was established, it is not impossible that its beautiful simplicity might, even at this day, have existed only in theory.

Sound policy, nevertheless, requires that, from time to time, such changes should be introduced in existing denominations as will tend to simplify the system, and to bring it gradually nearer to perfection; but even in these, perhaps, the law should follow indications of change dictated by convenience, rather than undertake to lead them.

A system of weights and measures and of denominations based upon that in common use in our country, would include the following particulars: first, a reference to some existing measure as the standard of length; as, for example, to a certain yard measure in the possession of the State, which should be declared at a certain temperature to be the linear unit. The multiple and submultiple denominations of this standard should be declared as lines or nails, inches, feet, perches, &c. Second, a unit measure of capacity, as, for instance, the bushel, should be defined in reference to the linear standard. This unit might be taken for both dry and liquid measures, or it might be deemed advisable to conform to usage by providing different units for liquid and for dry measure. In regard to the denominations an obvious improvement might be made by avoiding the use of the same name for things essentially different, as a gallon for different capacities according to its use in dry or in liquid measure, a change which would not fail to be sanctioned by general adoption. Third, a reference to a positive standard for weight, as a certain pound in the possession of the State. The multiple and submultiple denominations to be regulated. And here a question presents itself, whether it may be possible to have but one unit of weight denominated the pound, rejecting the troy or avoirdupois pound, as may be thought advisable. In choosing between them, the difficulty presents itself that the former pound has been legalised by Congress in our coinage, by referring to the standard troy pound in possession of the mint, while the latter is the pound generally used in commerce. It is probable that this innovation could not be made with advantage at present. In regard to the denominations a similar difficulty is presented in the ton, which is either 2,240 or 2,000 lbs. according to locality, or to usage, or to agreement. To the adoption of the ton of 2,000 lbs. technically called the short ton, there does not seem to be any insuperable objections. It is so convenient in practice that it has been legalized by several of the States, and is used in many cases in our own Commonwealth.

In providing for the distribution of positive standards throughout the State, the nature of the material of which they shall be made will be an important item. For the material of their positive standards of length, the French adopted iron, the English brass; for those of weight, the former employed platinum for the original standard, and brass for the copies; the latter brass for both. In case of the adoption of either metal, it would be important to inquire by experiment more carefully than has been hitherto done, into their relative expansions under different circumstances of manufacture. This would not bear merely upon the theoretical perfection of the standards, but upon that in practice, for two standards which were alike when made in winter, might, if compared in summer, differ so much that one would be thought to require the expense of alteration. If the yard stick of the merchant will not be changed by this difference, it will become sensible in the chain of the surveyor, and the landholder will find his limits affected by it.

Next, the positive standards thus provided should be referred to some natural invariable standard. The necessity for this reference is so frequently denied that the object would seem not always to be perceived. Positive standards are liable to change by accident and by use. Let us suppose a case in which a standard of measure belonging to the Commonwealth, and carefully deposited in one of its offices, receives injury in taking it down for examination or in course of a comparison of another measure with it. The county standards are resorted to, for the purpose of recovering the original length of the standard, but if not well preserved, or if frequently used, they disagree. It is in such a case, and the probabilities are strong of the occurrence at some time of similar cases, that the natural invariable standard becomes the means of deciding between the varying measures. The length of a pendulum vibrating seconds or the arc of a meridian is measured by using either of the measures; the length thus found is the same number of inches and parts of an inch with that of the pendulum or of the arc, which was previously fixed with reference to the original standard, or is so many parts of an inch too long, or too short, and the length of the original measure is known by reference to that which has been tested. But it is not necessary to resort to any supposition of accident which may occur to the positive standard; the experience of Eugland has shown that, under ordinary care, changes will be found from century to century, and that measures which are at one time easily known and recognized to be the standards, may at some other time be the subjects of antiquarian research. Part of the reproach under which the scientific operations here referred to lie, namely, that they are liable to corrections as science progresses, is due to the fact that experimenters have not been satisfied with stating the results of experiment, but have endeavored to deduce from

theory the relation between those results and others in other circumstances, using for this purpose the data furnished by the science of the day. Thus they have not been satisfied with stating that the pendulum vibrating seconds, and in a circular arc, measured with a means described, at a given temperature and pressure, and at a particular spot, was a certain number of inches of the standard; but they have undertaken from their experiment to conclude what the length would be in a vacuum, in a small arc, at an assumed temperature and pressure, at the level of the sea, and in a particular latitude, and these before the weight of the air, the effect of its buoyancy, &c. were well known and established, even according to the knowledge of the day.

The Committee, in the discharge of the duty committed to them by the Managers, proceed to submit their examination of the bill referred by the House of Representatives; in this they will be as brief as is permitted by the fact that many of the provisions of it are at this time the law of the State. If the Committee are correct in the ideas which they have already expressed in relation to the requisite enactments for regulating weights and measures, the objection to the bill, on the score of its leaving general principles to enter partially into details, is a sound one; this remark has reference more particularly to that part of the bill which relates to admeasurement, in relation to which it will be necessary for the Committee to go into minutiæ, in order to be intelligible.

The twenty-seventh and twenty-eighth sections establish a certain ratio between the weight of different commodities, and the measured bushel, in regard to which, as far as the usage of this portion of our State can be ascertained, four of the commodities mentioned are not bought and sold by weight; and of the two which are, one is always purchased at a different weight per bushel from that assigned in the sections, the brewers of Philadelphia always buying their barley at the rate of forty-eight pounds to the bushel. Salt of all descriptions pays duty at the rate of fifty-six pounds to the bushel, and is in all cases sold by measure. The usage will probably be found to be different in other parts of the State, for where materials are concerned which have weights in proportion to their bulk, varying with soils and seasons, or, as in the last case, with the moisture of the air, equitable dealing could not fail to produce such differences.

In regard to the scale of anthracite coal, provided for by section twenty-nine, no mention being made of the bituminous coal, usage has established its scale by weight, and no necessity exists for providing a ratio between measure and weight.

The measure of an acre of land, of a cord of wood, or bark, the contents of a hogshead of cider, each is made the special subject of a section, while other superficial measures, the measurement of lumber, &c., the contents of casks of beer, ale, whiskey, &c. &c., are left, as indeed all should be left, to the regulation of inspection laws, or to usage.

Section tenth is liable to similar objections, as providing for a peculiar form to be given to the bushel for measuring lime, which is one only of the many commodities sold by the heaped bushel. A provision for a legal standard bushel would regulate all such cases. The law provides in section seventh for both a wine and a beer gallon, a provision which the committee consider particularly objectionable, the inconvenience of two different measures having the same name, is obvious, and practice confirms the conclusion: the beer gallon being no longer, as far as the committee can ascertain, in use, at least in the city of Philadelphia.

The Committee would further remark, that they have not been able to find why the regulator of the weights and measures of the city of Philadelphia should not be subjected to the same enactments with other regulators or inspectors: the want of inspection laws to regulate the duties and fees of the office seems to be felt by the citizen who now fills, with industry and zeal, the office of regulator of this city.

Leaving these details, the Committee would urge a general objection to the portion of the bill referring to the positive standard for weights and measures. It is that, after providing for procuring those standards and distributing them, by means which would require an expenditure not at all, however, beyond the necessity of the case, it renders nugatory the whole of the work done, by providing that whenever the United States' standards shall be declared, those of the State shall conform thereto. The existence of a system which has cost the State much time and labor is thereby made contingent upon their obtaining standards which *may* be those adopted by Congress at some future day, or upon the want of action of the United States upon the matter. The difficulty of a change after a complete distribution of standards would necessarily be much greater than at a time when the want of some standard was generally admitted.

With great deference to the body who are

to consider the subject, the Committee have prepared an altered draught of a bill in conformity with the views which they have submitted in the foregoing, and which they respectfully submit for examination, under the supposition that legislation is, at this time, deemed advisable. The bill containing the general provisions for a system of weights and measures is accompanied by a supplementary one establishing the legal denominations. In regard to the manner of this appointment of regulators or sealers of weights and measures, to the securities to be required for the faithful performance of their duties, to the penalties for negligence, and to the penalties for infringement of the provisions of the bill, the Committee do not consider it within their province to offer any remarks, further than that they are of opinion that they may conveniently form a separate subject of legislation, and should not be incorporated with the general enactments.

The Committee will next proceed to a more grateful portion of their duty than that which required the criticism of the bill referred to them; namely, to consider the case in which action by the Congress of the United States may be deemed by the Legislature to be advisable. Next to the inconveniences which result from a varying standard of measure and weight in the same community or neighborhood, may be ranked those produced by a want of uniformity in the standards of different contiguous States; for it must happen, in a republic organized as is our own, that the different parts of the same State have less frequent communication requiring the use of such standards, than the adjacent parts of the different Commonwealths. So impressed are the Committee with this view, that they would express it as their decided opinion that the most imperfect system of weights and measures which has ever been framed, would, if applied in all the States of our Union, be preferable to the most perfect system which should be adopted by any one Commonwealth singly. The Constitution having delegated to Congress the power "to fix the standard of weights and measures," there seems to be no doubt but that that body have authority to legislate upon such a system as has been offered for the consideration of the House of Representatives of this Commonwealth, in which the object is rather to fix standards so that they shall not be liable to change for the future, than to make innovations in existing legal standards. Indeed, in most of the laws of more recent origin adopted by several States, there is a distinct provision, that when Congress shall furnish a system of weights and measures for the United States, the temporary State standards shall be made to conform to the national standard. The exceeding importance of uniformity is thus distinctly set forth, from quarters of the highest authority in the different parts of our extended republic.

In the multitude of objects to which the national legislation must be directed, it is hardly to be wondered at, that no action should have taken place upon this one. If the wants of the States, or any of them, should be expressed, Congress could hardly fail to take up a subject upon which so much unanimity of view might be expected. Frequent consideration has been given by that body to providing a system of weights and measures, even without the stimulus just referred to, as appears by a reference to the analysis of their proceedings accompanying this report. So far as the collection of the revenue is concerned, the object of uniformity in the standards is near its accomplishment, under directions, issued from the Treasury Department of the United States, for the distribution of standards to the custom-houses; and thus one motive which might have induced the action of Congress is removed, and the necessity for exertion on the part of the States, to secure so desirable an object, is increased. That standards issued to the custom-houses can be substituted for national standards, even though legalized in the collection of the revenue, by an act of Congress, is obviously impossible: unrecognized by the laws of the States which contain no provisions deferring to such standards; not placed at all in some of the States, and but sparingly distributed in any, they could not, even by usage, and in violation of the State laws, become standards. They would tend merely to increase the diversity of standards, and unless conforming to those of the State in which they were introduced, would cause duties to be paid on commodities by one measure or weight which were sold by a different standard. The Committee would therefore most respectfully request the Managers of the Franklin Institute, to urge upon the House of Representatives, of this Commonwealth, to call the attention of Congress, through our Senators and Representatives, to the necessity of fixing the standard of weights and measures throughout the United States; and further to suggest that the co-operation of the Legislatures of other States be obtained by executive communication.

Your Committee feel satisfied that the House of Representatives of this Commonwealth may lay the subject now under consideration before Congress in a form so con-

veniently adapted to their legislation upon it, that a speedy action will be ensured. But should this action be delayed for two or three years, the inconvenience of action under existing laws, for such a period, would hardly counterbalance the probability of benefit to be derived from legislation by Congress. If such just hopes should be disappointed, the people of this Commonwealth would then confidently look to the care of their legislature to furnish them with standards so essential to the dealings of all classes of the community.

COMMITTEE.

Alex. Dallas Bache,
S. V. Merrick,
William. H. Keating,
Rufus Tyler,
M. W. Baldwin,
Benjamin Say,
Asa Spencer,
Abraham Miller,
R. M. Patterson, M. D.
Sears C. Walker,
Benjamin Stancliff,
Thos. M'Euen, M. D.
Edmund Draper,
David H. Mason,
Benjamin Reeves,
Thos. P. Jones, M. D.
Frederick Fraley,
Samuel Moore, M. D.
Samuel Hains.

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An Act to fix the Standards of Measures and Weights in the Commonwealth of Penasylvania.

TABLE OF CONTENTS.

Section 1—Fixes the standard of linear measures.
" 2—Fixes the standard of capacity measures.
" 3—Fixes the standard of weight.
" 4—Determines the positive standard of length, to be provided by the Governor.
" 5—The Governor to provide the positive standards of measures of capacity.
" 6—The Governor to provide the positive standards of weight.
" 7—Provides for the preservation of the positive standards.
" 8—Provides for the verification of the positive standards.
" 9—Provides for the distribution of the county standards.
" 10—Provides for the verification of the county standards.
" 11—Positive standards to be referred to natural invariable standards.

An Act to fix the Standards of Measures and Weights.

Section 1.—Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennyslvania, in General Assembly met, and it is hereby enacted by the authority of the same: That the standard unit of all measures of length shall be the "yard," to conform to that in use in this Commonwealth, at the date of the Declaration of Independence, the positive standard to be obtained as hereinafter described; and that one-third of said yard shall be one foot, and one-twelfth of said foot shall be one inch.

Section 2.—And be it further enacted by the authority aforesaid, That the standard of liquid measure shall be the gallon, to contain two hundred and thirty-one cubic inches of the standard aforesaid, and no more. And that the standard of dry measure shall be the bushel, to contain two thousand one hundred and fifty cubic inches and forty-two hundredths of a cubic inch of the standard aforesaid, and no more.

Section 3.—And be it further enacted by the authority aforesaid, That the standard of weight shall be a pound, to be computed upon the troy pound of the mint of the United States, referred to in the act of Congress, of 19th May, 1828, to wit—the troy pound of this Commonwealth shall be equal to the troy pound of the mint aforesaid; and the avoirdupois pound of this Commonwealth shall be greater than the troy pound aforesaid, in the proportion of seven thousand to five thousand seven hundred and sixty.

Section 4.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor of this Commonwealth to procure, within — years from the date of the passage of this act, a standard yard, to constitute the positive standard of length in this Commonwealth; said standard to be equal in length, at the temperature of melting ice, to the distance between the eleventh and forty-seventh inches on a certain brass scale of eighty-two inches in length, procured for the survey of the coast of the United States, and now deposited in the war department. The material of said standard to be brass, and the divisions upon it to be inches and parts of an inch of the brass scale aforesaid.

Section 5.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor to procure, within — years after the passage of this act, for the use of this Commonwealth, a standard gallon and bushel, to conform to the provision of section second, of this act. The material of said standard to be cast brass.

Section 6.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor of this Commonwealth to procure, within — years after the passage of this act, a duly authenticated copy of the troy pound of the mint of the United States, to constitute the positive standard of weight of this Commonwealth. The material of said standard to be brass.

Section 7.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor of this Commonwealth to have the positive standards of measures of length and capacity, and of weight, provided by the foregoing sections, inclosed in suitable cases and deposited in the office of the Treasurer of this Commonwealth, to be by him there carefully preserved.

Section 8.—And be it further enacted by the authority aforesaid, That it shall be lawful for the Governor of this Commonwealth, when he shall deem it expedient, to have tested the conformity of said positive standards of measure and weight to the foregoing provisions of this act, or to the natural invariable standards hereinafter provided.

Section 9.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor to provide, within — years after the passage of this act, for each of the counties of this Commonwealth, at the charge of the counties respectively, duly authenticated copies of the positive standards of measures of length, of capacity, and of weight, referred to in the foregoing sections, of the material therein referred to, and of approved construction. And having caused the same to be duly stamped, to have them delivered to the Commissioners of the counties respectively, to be used as standards for the adjusting of weights and measures, and for no other purpose.

Section 10.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Commissioners of the respective counties, at least once in every ten years, and oftener if they have reason to believe it necessary, to cause the standards of the respective county to be examined and tried, and, if necessary, to be corrected or renewed according to the standards of the Commonwealth heretofore referred to.

Section 11.—And be it further enacted by the authority aforesaid, That it shall be the duty of the Governor, within — years after the passage of this act, to cause the positive standards, herein described, to be referred to natural invariable standards, and to deposite in the office of the State Treasurer the authentic certificates of such reference, with the apparatus by which it was made. The length of the standard yard to be compared with that of the pendulum vibrating seconds at a certain and defined spot in the Independence Square in the city of Philadelphia or in some unalienable public property, at an ascertained and convenient temperature and pressure; all the circumstances of the comparison to be stated. The standard of weight to be compared with that of one hundred standard cubic inches of water, at its maximum density, and at a convenient atmospheric pressure.

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An Act to fix the Denominations of Measures and Weights in the Commonwealth of Pennsylvania.

TABLE OF CONTENTS.

Section 1—Fixes the denominations of linear measure.
" 2—Fixes the denominations of superficial measure.
" 3—Fixes the denominations of liquid measure.
" 4—Fixes the denominations of dry measure.
" 5—Fixes the denominations of weight, which refer to the troy standard.
" 6—Fixes the denominations of weight, which refer to the avoirdupois standard.

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An Act to fix the Denominations of Measures and Weights.

Section 1.—Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania, in General Assembly met, and it is hereby enacted by the authority of the same: That the denominations of linear measure of this Commonwealth, whereof the yard, as heretofore provided, is the standard unit, with the relations thereof, shall be as follows:

12 inches make 1 foot.
3 feet make 1 yard.
5½ yards make 1 rod, pole, or perch.
40 rods make 1 furlong.
8 furlongs make 1 mile.

Section 2.—Be it further enacted by the authority aforesaid, That the denominations of superficial measure of this Commonwealth, whereof the square of the linear yard, as heretofore provided, is the standard unit, with the relations to said standard, and to each other, shall be—

30¼ square yards make 1 pole or perch.
40 square poles make 1 rood.
4 square roods make 1 acre.
640 acres make 1 square mile.

Section 3.—Be it further enacted by the authority aforesaid, That the denominations

of liquid measure of this Commonwealth, whereof the gallon, as heretofore provided, is the standard unit, with the relations to said unit and to each other, shall be—

4 gills	make 1 pint.
2 pints	make 1 quart.
4 quarts	make 1 gallon.
31½ gallons	make 1 barrel.
2 barrels	make 1 hogshead.
2 hogsheads	make 1 pipe.
2 pipes	make 1 ton.

Section 4.—Be it further enacted by the authority aforesaid, That the denominations of dry measure of this Commonwealth, whereof the bushel, as heretofore provided, is the standard unit, with the relations to said standard and to each other, shall be—

4 pecks to make 1 bushel.

And the minor divisions of the peck shall be its aliquot parts. Provided, that the form of the dry measures shall be conical, that the diameter of the circle of the top of the measure shall be not less than one twentieth greater than the diameter of the bottom of the measure, and the height not more than nine twelfths of the diameter of the bottom.

Section 5.—Be it further enacted by the authority aforesaid, That the denominations of weight of this Commonwealth, whereof the troy pound, as heretofore provided, is the standard unit, with the relations thereof to said standard and to each other, shall be—

24 grains	make 1 penny-weight.
20 penny-weights	make 1 ounce.
12 ounces	make 1 pound.

Section 6.—Be it further enacted by the authority aforesaid, That the denominations of weight of this Commonwealth, whereof the pound avoirdupois, as heretofore provided, is the standard unit, with the relations to said pound and to each other, shall be—

16 drams	make 1 ounce.
16 ounces	make 1 pound.
25 pounds	make 1 quarter.
4 quarters	make 1 hundred.
20 hundreds	make 1 ton.

We have received the Mechanics' Banner and the Working Men's Shield, a new paper established in the city of Baltimore, by Mr. Robert Ricketts, devoted to the interests and improvement of the working class. From the number which we have received, we should judge it to be a paper well edited, and to say the least, it bids fair to be an able advocate of the cause it espouses. The editor, among other subjects, gives the following true picture of the *Vicissitudes of Life.*

The clergyman, as he weeps over his stubborn flock, and sees them in spite of his prayers and entreaties pursuing "the error of their way," exclaims, "surely none have difficulties like the minister;" and the physician, as he rouses from his midnight sleep to encounter the chilling winds of winter, and comes shivering to the bedside of his patient, rubs his thumb over his lancet, and says, "would that I had never been a doctor." The farmer, as he tills his land, from the rising of the sun until the going down of the same, "sowing his seed in the morning, and on the evening withholding not his hand," stands kimbo upon some sun-parched field, and as he views the scorched grain and withered grass, bending their tops to the burning soil, with a smileless lip he says, "woe is me, for my troubles are past endurance;" and the slave, as he lifts his hand from the spade that is worn smooth by his grasp, raises his fettered arm towards the heavens, and execrates the light that hails him to his toil. The politician pours for years over some splendid scheme, and fancies the day not far distant when he shall fill to the brim the measure of his own with his country's glory; he starts as the tide of public opinion comes rolling against him, resistless as the Simoon of the sandy desert, and the dying away of the winds bears his moan upon their bosom—"vain and vexatious are the pursuits of the statesman." The lawyer ransacks the musty doings of past ages—studies hard and long to effect the overthrow of his opponent, piles up and pulls down, and turns over and over again the pages of innumerable volumes, speeds his way, loaded with books to the court room, contemplates his success, and already fancies his name to be recorded upon the highest Collocate upon the column of fame. He lifts his voice amid the learned assembly, and the plaudits of the admiring multitude cheer him onward. He submits his case to the jury, and retires from the court flushed with satisfaction, and blushing beneath the high honors of his auditory; he seeks his client, and tells him to rejoice, and like a hero returning from his victory with the laurel of triumph upon his fevered brow, he enjoys a momentary glow of exalted pleasure; but, alas for him, the return of the jury reverse the verdict his own imagination has conceived, and he hates the hour he was born. The merchant tarries till the breaking of the day at his gas light desk, and counts and calculates with a sleepless age, and an anxious heart; thousands are his due, but they are held by his fellow-men; he fondly believes it all secure, and exults in the *expectation* of happiness; one failure,

and another, and another, take place; he denounces the whole human race, and in the moment of his distress reflects upon all the world of men as scoundrels but himself.

The warrior, as he rushes to the crimson plain, covers his course with the bodies of the dead, and as he sinks with the steel in his heart, his last cry is "the soldier's career is attended with doubt, danger, and difficulty, and his reward is death." The sailor springs from his hammock slumbers, and as he mounts the yards, in the solitary watch of the night, mingles with his "yo heave" a curse upon the difficulties of life. The mechanic toils from sun to sun, and as he returns from the monotony of his daily avocation, he ponders over his oppressed situation, —his home, his wife, his children, all gather about his heart; the feelings of his nature rive him to the quick, and he fain would lift his arm and cry, *these things shall not be*, but finds it fettered, and his free-born soul is goaded by the scorpion sting of imposition, as he bends his neck again to his slavish toil. But the printer, the poor printer—who shall begin to sum up the amount of his difficulties? Human language and human effort are inadequate, and human calculation, with all its catalogue of human woes, reach not the deep recess where spring the printer's difficulties. The tears of the clergyman, the shivering of the physician, the fears of the farmer, the distresses of the slave, the failures of the politician, the mortifications of the merchant, the despair of the conquered soldier, the woes of the sailor, and the mechanic's bitter reflections—all, all, and a myriad more, harrow the printer's heart. The calender of human evil, like the solar sun, sends its converging rays, and all concentrate upon the printer's head. The printer must hear every thing, feel every thing, see every thing, know every thing, and tell it in the right time, or he knows nothing about his business; he must be a very Proteus in every sense of the word; his calvarium must be marked by every bump in Gall and Spurzheim, and then he will do well to prepare himself for abuse and fault-finding. We have said all of the above, courteous reader, by way of apology for the long delay of the second number of our paper; and if we have not said enough, may the shades of Charon help us, for we had better gather up our spoils and prepare for a journey across the Stygian Lake. We are inclined to think that we will never commit the sin of getting up another paper. We saw difficulties in the commencement, and prepared to surmount them; but the strained imaginations of the most untrammeled poet never conceived, in his boldest flight, the Alpha of our troubles: what the Omega shall be, time must write.

On the Probable Location of Railroads and Canals. To the Editor of the American Railroad Journal, &c.

Sir,—A writer, who signs himself "C. O."* (Deep Creek,) has suggested a few remarks on the location of railroads and canals, in which he proposes to call attention to the proper direction of these works, so as the meet the general improvements now progressing in our extensive country, and to adapt them to such advances as future enterprise may produce. He has, however, only touched the outline of the subject, without investigating the principles upon which such works should be conducted: considerations which are indispensable for the accomplishment of the object proposed. In the following views, the inquiries of "C. O." are pursued and extended, and, it is hoped, illustrated in such a way as to call the attention of the public to an examination of this interesting subject.

It may be very difficult, in treating a subject of this kind, to avoid the consideration of the question which of the two modes of conveyance, railroads or canals, is to be preferred, and likely to supersede the other in public estimation.

As the subject has been investigated by the ablest engineers, and others qualified to judge, both in Europe and the United States, the whole of which is to be found in the preceding pages of the Journal, it will be avoided, so far as may be done without leaving the matter under discussion imperfectly explained.

The subject of canalling in our country has been the theme of such profound inquiry—the several practicable and even possible routes and plans for such works so often made the subject of minute estimate and investigation—that it may be said to be in a manner exhausted. It is at this time scarcely possible to find a line of country of any extent, through which such work could be opened without incurring an expenditure not be justified by the profits. The success of the Hudson and Erie Canal in New-York has induced numberless efforts of this kind, and awakened an almost enthusiastic zeal in favor of them. The public were captivated by the brilliant results from this gigantic enterprise, not only in the amount of tolls, but also in the universal improvement in the value of the landed property which followed its completion. But in how few other cases has success attended the opening of canals? Even in the state of New-York, many of the canals which have been made since the completion of the first great work have been failures, and are now supported from the profits of the one first completed.

The great canal now under construction from Washington city to the Ohio, (the Chesapeake and Ohio Canal,) if ever completed, is not expected to afford tolls to the amount of 2 per cent. on its cost; and yet this passes

* See Mechanics' Magazine, vol. iii., p. 366.

through a country abounding in agricultural production, and mines of valuable minerals.

The Delaware and Chesapeake canal is understood to be an unproductive stock; and the canal, through the Dismal Swamp, which has been more than 30 years in progress, now that it is completed, is found to produce a very meagre dividend in tolls. Of the canals cut by the state of Pennsylvania, and the chartered companies within its limits, scarcely one in ten is expected to be profitable stock, and its citizens are now turning their attention to railways, &c., as a substitute for them. In short, there is scarcely a great work of this kind, (the Hudson and Erie Canal excepted,) which has not terminated unfavorably to the adventurers. It is not proposed to enter into an inquiry what, in our country, has been the cause of these failures in canals —works which are so productive in the European states; but merely to assume the fact, as one which will not be controverted by persons experienced in these works, that, in our country, canals are enterprises attended with danger of loss to the parties adventuring, and that there are few situations when they could be attempted, (on a large scale at least,) without hazard of the loss of capital.

With respect to railroads, the matter may be said to be very different. They may, it is believed, be constructed under many circumstances in which canals are inapplicable, at less cost, and an almost absolute certainty of giving a better return in tolls for the capital employed.

The following are the principles which, it is believed, should direct the selection of a route for a railroad, and which, if practised on, will insure success, without regard to future changes or contingencies.

In the first place, railroads should be laid out to run from the fertile districts of the interior of the states, to some (the nearest) seaport or navigable waters, whence the articles conveyed on them may be transported to a foreign or distant market.

2dly. The great intercourse now subsisting between the seaport towns on the Atlantic require the benefits of this mode of conveyance. The time cannot be far off when this intercourse will be increased to an indefinite extent. In the interim, railroads may be built with a certainty of profit between any of these cities, until a continuous line is finished from Boston, (perhaps Portsmouth, N. H.,) to St. Mary's, in Georgia; and it is probable the line might be safely extended from St. Mary's to St. Mark's, on the Gulf of Mexico, the intervening country between the two places having been ascertained by Gen. Bernard to be eminently favorable to such a work, (the peninsula being only 150 miles across, and the highest land on the ridge about 50 feet above the level of the ocean.)

Another class of railroads which promise certain profit on the capital invested, are the lateral roads which will be run from the mines of coal, iron, lime, plaster, &c., which abound in the mountainous region of some of the states, to some road or canal extending from the fertile interior districts of the country to a seaport. The number of lateral roads which will be required for the transport of these products of the mines, must be matter of conjecture. Every day adds to the discovery of beds of valuable mineral substances, and to the number of mines opened: from all which lateral roads must be constructed to intersect the nearest railroad or canal to navigable water. Many of these are already in profitable operation, and are connected with some main line of railroad or canal, by which the produce of the mines is conveniently carried to market.

From what has been said, it would seem that canals offer few inducements for the enterprising to engage in their construction; that few situations in our country are adapted for this purpose, unless at an expense which the profits will not justify; that, if constructed at all, the selection of the routes must be left to the judgment of the engineer, looking to the probable advances of the country in other general improvements; that no definite rules can be laid down for their construction, their success depending upon so many contingencies, not likely to be united in their favor, &c. But that railroads may be undertaken with confidence of success, wherever they are made to run from a seaport or navigable water to a district of the interior country, which affords a large quantity of valuable agricultural or manufacturing products; that they will succeed, if run from one seaport to another, everywhere on the Atlantic coast, from Portsmouth, N. H., to St. Mary's, Ga., and probably across the peninsula to a port on the Gulf of Mexico, (as St. Mark's;) and, lastly, that they will probably yield a certain and profitable return, when run laterally from beds of mineral products, to intersect other main railroads or canals leading to a place of export.

The introduction of locomotive engines, to propel carriages on railroads, has greatly added to the utility of this mode of conveyance; and the improvements which modern enterprise has made in their structure, increasing, to an almost unlimited extent, the power of the engine, and at the same time giving greater strength, and affording a surer protection from casualties, will serve to exalt them in the public estimation and insure their universal employment.

CIVIS.

LEAD MINES.—No lead mines in the world are supposed to be richer or more abundant than those of Missouri, on the borders of the Mississippi. The ore is often found within two feet of the surface of the ground, in detached masses, weighing from one to eighteen hundred pounds. The annual produce is calculated to be three millions of pounds.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum, *in advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

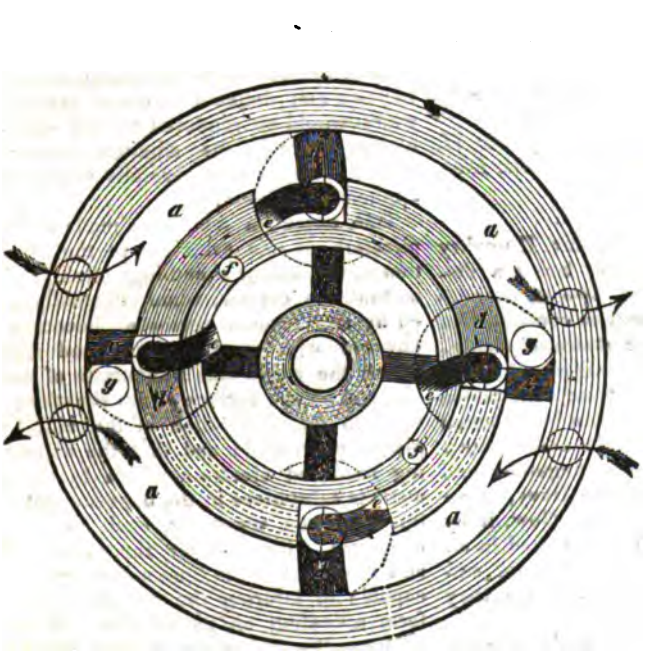
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] SEPTEMBER, 1834. [NUMBER 3.

"Who steals my purse, steals trash; 'tis something, nothing;
'Twas mine, 'tis his, and has been slave to thousands!
But he that filches from me my good name,
Robs me of that which not enriches him,
But makes me poor indeed."—SHAKSPEARE.

NON-RECIPROCATING ROTARY ENGINE.



To the Editor of the Mechanics' Magazine:

SIR,—Be it known, that I, Ami Clark, of Berlin, in the county of Hartford, and State of Connecticut, have invented a steam engine, and that the following is a description thereof. *a a a a* is a circular cavity, formed principally by two concentric cylinders, of which the parallelogram *a*, fig. 2, is a sectional view; *c c* are standing blocks in the cavity, secured to the inner surface of the outer cylinder. Fig. 2, a side view of one of the four valves, marked *d d d d*, in fig. 1, which are secured to the outer surface of the inner cylinder, and form, when closed by the rollers *g g*, a part of the outer surface of the inner cylinder, as shown at the standing blocks, for the purpose of passing them with facility; *e e e e*, figs. 1 and 2, the spanners, or keys, which, by coming in contact with the rollers, *f f*, will turn the valves, radiating from the centre, to receive the pressure which will propel them from the standing blocks, and cause them to run their circuit. Two of the valves are acted upon while two are passing the blocks, and thus twice the surface measure of a section of the cavity is acted upon continually while steam is applied.

As the steam is admitted on opposite sides at the same time, it will be seen that the

pressure, however great, will not generate friction. This engine gives no motion but circular; the advantage in this respect over the reciprocating I need not mention. It is obvious to every mechanic, that in continually changing or reversing the motion of heavy bodies there is great loss of power. It will be necessary to have two valves to one block, that the pressure may not generate friction; the more standing blocks and valves there are, the less the weight of the engine in proportion to the power. The circular cavity ought to be small in diameter, and the cylinders which form it can be made with sufficient length to acquire the surface measure requisite. The blocks may be secured to the outer surface of the inner cylinder, and the valves to the inner surface of the outer cylinder, if preferred, which will cause the outer cylinder to revolve.

AMI CLARK.

On the Application to the Arts of Sir H. Davy's Discovery, resulting from his Electro-Chemical Theory.

To the Editor of the Mechanics' Magazine:

SIR,—It was supposed by Sir Humphry Davy, that instead of affinity being a distinct species of attraction, two substances had a tendency to unite only in consequence of their being in opposite states of electricity. This view of affinity suggested to Sir H. a matter of very great importance—a mode of preventing metals from being acted on by oxygen. The metals are electro-positive, and oxygen electro-negative, and this is the reason, according to Davy, of an affinity existing between them. Now, if by any means the metals can be retained in an electro-negative condition, they cannot suffer oxidation, or, in common language, they cannot *rust*.

The importance of some mode of completely preventing oxidation must be evident to all, since the evil effects of oxygen on articles composed of metal are daily witnessed. The substance employed in rendering iron or steel electro-negative is *zinc*. A very small quantity of this metal applied to any article composed of iron or steel, will completely prevent the action of oxygen upon it, whether exposed to air or water. All articles of cutlery whatever, all iron, steel, or copper instruments used by mechanics, (excepting those which are exposed to fire,) all farming utensils—axes, hoes, sickles, scythes, plough-shares, chains, &c. &c. can be effectually prevented from "rusting" by the application of a very small quantity of zinc, soldered to them in any place where it could be the most conveniently done. The expense of the zinc for this purpose is exceedingly trifling. "A piece of zinc," says Dr. Turner, "as large as a *pea*, or the head of a small round nail, was found fully adequate to preserve 40 or 50 square inches of copper—and this wherever it was placed, whether at the top, bottom, or middle of the sheet of copper, or under whatever form it was used."—[Turner's Chemistry, p. 99. American edition.]

This brilliant discovery of Sir H. Davy's, the result of his *Electro-Chemical Theory*, was first applied to the copper sheathings of ships, which all know are very expensive, and last but a short period, in consequence of their being constantly acted on by oxygen, and the hydro-chloric acid of sea-water. The application of this discovery to the preservation of instruments composed of iron or steel was first suggested by Mr. Pepys; and delicate surgical instruments, which would be rendered useless were their cutting parts in the slightest degree oxidized, are now kept perfectly bright by the application of zinc.

One objection has been made to the application of this principle to the preservation of the copper sheathings of ships, which is, that the copper, when effectually guarded by zinc against corrosion, becomes soon covered with marine plants and animals, which the oxide and submuriate of copper, (formed on the surface of the sheathing previous to the application of the zinc,) completely prevented; and that the copper, being rendered electro-negative by the zinc, attracts substances in the opposite state contained in the sea-water, such as lime and magnesia. But neither the marine plants and animals, nor the lime and magnesia, are capable of injuring the copper; they only form a coating on its surface. When we compare the endurance of these difficulties, admitting that the above objections are well founded, with the short space of time that a copper bottom lasts, and the enormous expense of renewing the copper, they appear as nothing. Besides, it is the opinion of men of science, that by a skilful adjustment of the proportions of copper and zinc, or iron, which can be used instead of zinc on copper, these objections can be completely removed. However weighty these difficulties may be, they are confined solely to the application of zinc or iron to the copper sheathings of ships; they are not made to the application of zinc to metallic instruments.

One more advantage, and perhaps the greatest of all, arising from this discovery of Davy's, is that *iron* can be used instead of copper on the bottoms of ships, thus vast-

ly reducing the expense of sheathing. The zinc as effectually prevents any chemical action on the iron as on the copper, and hence one is as good for the purpose of sheathing as the other.

The numerous experiments which have been made by men of science since this discovery of Sir H. Davy, have fully established its value and importance, and it now remains for men to apply it to some useful purpose.

I am aware of no use having been made of this valuable discovery except in the preservation of ships' bottoms and surgical instruments; and why, I ask, do not mechanics avail themselves of its advantages? It cannot, I think, be possible for any well informed mechanic to be ignorant of any of the facts above stated. If any one is, it must be his own fault. Books are as "cheap as dirt," and if any mechanic will say he cannot buy a few books on science, and that he has no time to study books if he had them, he is poor indeed, and leads a slave's life. Such a man I sincerely pity. But what shall I say to those who *do* understand this principle—this discovery of Davy's—who do not make some application of it? Go into the workshop of the different mechanics, and see their tools undergoing constant corrosion. Go to our wharves, and see all the iron work of ships covered with rust—their anchors and chain cables covered with oxide. Go to the printing office, and see the press red with the oxide of iron—the chases and composing sticks also covered with the same. Look at the steam engine, the most ingenious, useful, and probably the greatest of all inventions, and think whether Sir Humphry Davy's discovery could not be applied to that.

Wherein is the world benefitted by any discovery, if no application be made of it? To what purpose do we rack our brains in acquiring knowledge, if we make no use of it when obtained? People seem afraid to adopt any thing new. Any new invention or discovery, if it be ingenious, they view with delight; but the thought does not seem to occur to them whether it can be applied to any useful purpose; and if any one attempts the application of a new principle, be it what it may, there are thousands ready to laugh at him, as they did at Fulton, in his exertions to show to the world the use and value of that machine of all machines—the *Steam Engine.*

Ships are constantly building and being coppered, without the least regard to this invaluable discovery; and why is it? Are shipbuilders and shipowners ignorant of the existence of this cheap and effectual preventive against the ravages of the elements, or have they tried it and found it ineffectual? If they have, I am not aware of it.

If any of the correspondents of the Magazine will point out any thing new on this subject, many of whom probably can, I, for one, should be highly gratified. A.

We have just received information from a friend, who has been on a visit to Livingston county, that he saw in operation on the Genesee Flats, near Moscow, a machine working by horse power, which, with the assistance of one person and a pair of horses, can cut down from fifteen to twenty acres of wheat in a day. The wheat as cut is received on a platform; and connected with the machine is a revolving rake, which takes off the wheat and leaves it in heaps of proper size for binding into sheaves, and it keeps eight men busily employed in binding them up. We shall endeavor to get a drawing and particular description of this machine for our next number.—[Ed. M. M.]

A Map of the Railroads and Canals in the United States, with a Concise Description of each. By D. K. Minor, Editor of the Railroad Journal. 18mo. pp. 72. New-York, Minor & Challis.

Prefixed to the description which accompanies this valuable map is one of those plain, intelligent, and concise introductions, (the *multum in parvo,*) which are ever found at the commencement of works of standing merit, and which in most cases induces us to place great reliance on the correct manner in which a work is got up. The author asks for information of "important or even trivial errors" which may be discovered in the work. It is thus and thus only that the scholar and the philosopher can arrive at true knowledge; and if we mistake not, it is by such a course, combined with undeviating perseverance and integrity, that our author has elevated himself from one of the working classes to be one of the most influential disseminators of useful knowledge in the United States.

His observations generally are worthy of an attentive perusal, and are of the deepest interest to our citizens, none more so than where he speaks of a "Steamboat Canal from the Hudson to Lake Ontario, thence round the Falls of Niagara, and thence from Chicago to the navigable waters of the Illinois river." He states, "this is a work,

or rather these are works, which will be accomplished, and become to this Union the CABLE of safety, while other works stand as the rigging of the ship;" and his concluding remark is well worthy of observation, and predicts what we trust will be fulfilled to the letter, and *that* long before the allotted time is expired, namely, that another quarter of a century will accomplish more than is marked out in this map. We find there are descriptions of 93 Railroads, and a valuable account of 17 more; also, a particular account of 49 canals, making together an account of 159 railroads and canals, and all comprised in 72 pages, realising the story of Homer's Iliad contained in a nut-shell. It is well drawn and engraved (by Mr. W. Norris); the rivers and mountains are plainly delineated, and the places through which the railroads and canals pass distinctly pourtrayed, distinguishing those *finished, making, contemplated*, and *chartered*; and in the margin are valuable graduated profiles of most of them.

A romantic view of the Erie Canal at the Little Falls forms a beautiful vignette to the map.

If civilization increases by communication, the speedier and easier it be made, either by land or water, the better. Thus the United States, by means of her railroads and canals, will attain the highest perfection of civilization in the world—her treasures will be easier collected; and, it must be admitted, that as civilization increases, so does knowledge. "Knowledge is power," and as Dr. Birkbeck has well expressed, "it is also wealth, and security—enjoyment, and happiness;" it becomes at once a guide to that "temple which is not made with hands, eternal in the heavens." Entertaining these opinions, we most cordially recommend this map to our readers, as one means of promoting an object so "devoutly to be wished for." J. K.

A Complete Catalogue of Drugs, Chemicals, Varnishes, Perfumery, Apparatus, Instruments, Tests, and every Article used by Physicians and Apothecaries, Theoretical and Practical Chemists, Lecturers on Natural History and Philosophy, and Mechanics applied to the Arts. By Dr. LEWIS FEUCHTWANGER, 377 Broadway. New-York, 1834, pp. 12.

This very ample catalogue, filling 12 octavo pages, comprises all that the most scientific scholar may require in the pursuit of knowledge, and all that the mechanic may want to carry the most abstruse theory into practical demonstration. The physician, and his drudge the apothecary, can here be supplied; and with the chemist, can search Nature in all her departments, whether animal, vegetable, or mineral. The doctor seems to have collected her varied treasures in them all, and have ransacked air, earth, and water, for them. His catalogue comprises upwards of 1450 articles, of which there is an extensive stock of chemical preparations, mostly manufactured by himself, or of European importation by him, during the space of four years, which time he has carried on business in this city.

The doctor is well known to us as a very able and scientific chemist, and has contributed some very excellent articles thereon to several of our leading scientific journals. His remarks on arsenic, with drawings of the color of its precipitates, formed by reagents applied to them, communicated to the American Journal of Science and Arts, vol. 19, No. 2., is ably written, and was much commended; so were his several papers on the ore of platinum, on gold, on mercury, and on amber, inserted in the Magazine of Useful and Entertaining Knowledge, published in 1831 in New-York, all proving that he not only possesses theoretical, but practical knowledge: such a one as can assist the scholar and the mechanic in their several labors. To such we recommend the doctor and his catalogue, which is very clearly and scientifically arranged, and well classified, so that at a glance each can see what is wanted, and thereby save much valuable time. We anticipate we are not doing wrong when we recommend a scientific man, and yet a practical one, to the mechanics as a tradesman. It is such a one they want, for mechanics and chemistry ever go hand in hand together, though chemistry may be the elder sister, for Tubal Cain, according to the Mosaic history, first taught the art of extracting iron and copper from their ores. T.

Observations on the Epidemic now prevailing in the City of New-York, called the Asiatic Spasmodic Cholera, with Advice to the Planters of the South for the Medical Treatment of their Slaves. By CHRISTOPHER C. YATES. Second edition, 1832, pp. 57. New-York, Collins & Hannay.

No work is more acceptable at the present time, when the cholera is again raging around us, than the above able observations made from experience aided by science, and we trust our readers, if they have not read it, will procure one at once; and if they are fortunate in having one in their library, we recommend a re-perusal thereof, for it will

tend to dissipate the alarm which epidemics always engender, as also point out the plainest and most simple mode of cure, namely, "by removing as speedily as possible the offensive matter from the stomach and intestines, in the manner that Nature indicates by her perhaps too feeble efforts, *vomiting* and *purging*, and allaying the spasmodic affection by anodynes." The author states that by this course of practice no case proved fatal under his care. Subsequent experience since 1832 has confirmed his views; and though he expresses a fear of being called mad by those who, (as in 1812 and 1813, the period of the "Winter Fever," and in 1822, the season of the Yellow Fever,) differ with him, yet his fears have not been varified; but, as before stated, experience has confirmed his practice. The present Board of Health here have adopted his advice *of making a daily report of deaths only*, and we trust his brother physicians will adopt his course of evacuants. To the mechanic we should say, read attentively that part of the work on diet and drinks in reference to epidemic cholera. The author there prefers salt to fresh meat, ale and porter to spirituous or vinous liquors, and we wish all of them may follow this advice; and then, as the doctor states, he will be enabled to return to his toil with a light heart, a cheerful countenance, and vigorous muscle.

The pamphlet contains most excellent and scientific observations on the nature and cause of the disease, from the commencement to the conclusion thereof, and it finishes with an able epitome of the opinion and practice of the most eminent among the Medical Faculty of Paris, founded on the report of the cholera at Paris.

After reading this work, the name of cholera, (which has proved here and in Europe more epidemic, infectious, and dangerous, than the disease itself,) will no longer be a bugbear to frighten our artisans from their peaceful labors, and drive trade from our shores. In 1832 the work was much read, and we now, in 1834, recommend the author to favor us with another edition. It has done, and will yet do, more good, by dissipating groundless alarms and gross medical errors, alias experiments. There is no quarantine here yet as to the disease, and the Board of Health report deaths only, both of which are advised and written on by the author, therefore his advice of 1832 is now followed in 1834, and is our reason, amongst others, for advising him to publish another edition. We know it will repay him, even by the purchasers from amongst the mechanics.

T.

MECHANICS' STATE CONVENTION.

Proceedings of the State Convention of Mechanics, held at Utica, August 21–22, 1834, for the purpose of taking into consideration the Effect produced on the Various Mechanical Trades by the Present System of State Prison Discipline.

The Convention of Mechanics, on the subject of State Prison Monopoly, assembled at the Court House in Utica, on Wednesday morning, August 20th, 1834, when JOHN MEADS, of Albany, was chosen President pro tem., and ROBERT TAYLOR, of New-York, and J. O. COMSTOCK, of Schenectady, Secretaries pro tem. It was then

Resolved, That the credentials of delegates be now presented and called, which being done, ninety delegates answered to their names.

It was then, on motion of Mr. J. P. Simpson,

Resolved, That a committee, to consist of one delegate from each county represented in the Convention, be appointed to select and nominate a President, two Vice-Presidents, and two Secretaries, as permanent officers of this Convention, and that said committee be instructed to report at the opening of the Convention this afternoon. Whereupon the following gentlemen were appointed said committee: Austin Baldwin, David Anderson, Alexander Gray, R. M. Carrington, Joseph Stillman, W. E. Lathrop, John Richardson, Warren Hecox, Earl D. King, Rudolph Snyder, Ira Tillotson, Francis Collingwood, Lewis S. Ayres, Farnham White.

The Convention then adjourned to meet at 2 o'clock, P. M.

AFTERNOON SESSION.

August 20, 1834.

The committee appointed to nominate permanent officers, reported the following, viz.:

RUDOLPH SNYDER, of Utica, President; ANSON BAKER, of New-York, and FREDERICK STARR, of Monroe county, Vice-Presidents; ROBERT TAYLOR, of New-York, and RICHARD HOGARTH, of Ontario county, Secretaries.

On motion, the report was accepted, and these gentlemen being unanimously elected, took their seats.

A letter was then read, addressed to the President of the Convention by B. Birdsall,* of the New-York delegation, who could not

* This letter was either not handed to the Committee of Publication, or has been mislaid; and therefore is not published.

attend, which was ordered to be placed on the minutes of this Convention.

On motion, the Central Corresponding Committee of Oneida county were invited to take a seat in this Convention, and a committee of two, Mr. King and Mr. Russ, was appointed to wait on them and inform them of the resolution.

A communication from Mr. Waydell was read, and, on motion by him, laid on the table for further consideration.

Mr. Baldwin offered the following resolution, which was adopted:

Resolved, That a committee of ten be appointed to draft an Address and Resolutions setting forth the views of the Mechanics of this State with regard to the existing State Prison Monopoly. The resolution being adopted, the following gentlemen were appointed to constitute the committee, viz.: Robert Taylor, Richard Hogarth, Edward Mead, John Mead, Nathan D. Sherwood, Arden Seymour, D. K. Minor, J. O. Comstock, Bill Colby, John Richardson.

Mr. Elbert J. Willet, a delegate from Lansingburgh, presented his credentials and took his seat.

A communication was received from the Utica Mechanics' Association, tendering to the members of the State Convention of Mechanics the use of their reading room, and such other attentions as may be deemed necessary and proper.

The Committee on Address and Resolutions retired, whereupon Austin Baldwin was appointed to act as Secretary until their return.

EVENING SESSION.

August 20, 1834.

The Convention having been called to order, Mr. T. Thompson, of Trumansburgh, presented his credentials and took his seat. Mr. Thompson then presented two resolutions, passed at the meeting by which he was appointed, which were read and laid on the table.

Mr. Abner Cutler was admitted as a member from Buffalo.

MORNING SESSION.

August 21, 1834.

The President took the chair, when the roll was called and the minutes of the preceding evening read. A letter was received and read from the absent members of the Buffalo delegation, which was, on motion, referred to the Committee on the Address and Resolutions.

The credentials of the Troy delegation were read, whereupon they were admitted and took their seats.

On motion, Resolved, That a Central Committee be appointed at Utica, as a Committee of Correspondence. The following gentlemen were appointed to constitute that committee, viz.: Rudolph Snyder, Ephraim Hart, E. Wells, Harvey Barnard, Augustus Hurlburt, and Riley Rogers.

On motion, it was then Resolved, That the following gentlemen be appointed to act as a Corresponding Committee for each county, viz.:

Kings—Samuel S. Powell, David Anderson, Brooklyn.

New-York—Joseph P. Simpson, Anson Baker.

Westchester—Frs. Kain, Stephen Ward.

Albany—John Meads, Samuel S. Steel.

Rensselaer—E. J. Willet, Lansingburgh; Lyman Garfield, Troy.

Schoharie—J. S. Bonney, Austin Knowles.

Niagara—Elliott Lewis, Lockport.

Dutchess—Jas. Mills, Poughkeepsie; A. A Comstock, Stamford.

Schenectady—Alfred Stillman, John Allen.

Saratoga—Nathan D. Sherwood, Waterford; Moses Williams, Ballston Springs.

Washington—John Adams, Salem; John Horton, Union Village.

Oneida.—Arden Seymour, Rome; Thomas Williams, Vernon.

Cortland—Harman J. Short, David Coy, Homer Village.

Steuben—James May, Thomas Thompson, Bath.

Warren—Sheldon Benedict, John A. Ferris, Glens Falls.

Tioga—Gideon O. Chase, East Jury District; Wm. R. Judson, West Jury District.

Tompkins—Otis Eddy, Almanzer Tufts, Ithaca.

Cayuga—Daniel Hewson, Curtis Stevens, Auburn.

Onondaga—Edward B. Wicks, George W. Parsons, Syracuse.

Erie—J. W. Beals, E. D. Efner, Buffalo.

Ontario—Richard Hogarth, Geneva, Earl D. King, Canandaigua.

Chenango—Truman Enos, Morris; L. R. Hopson, Sherburne.

Broome—Lewis Pratt, E. W. Dewey, Binghamton.

Oswego—Wm. C. Rogers, Elisha Carrington, Oswego.

Yates—A. H. Bennet, J. F. Terrill, Pen Yan.

Seneca—Daniel Pomeroy, Ovid; Henry S. Lysk, Waterloo.

Wayne—Erastus Burt, Stephen Dunwell, Newark.

Genesee—Chauncey Kirkham, Batavia; Newman Ferris, Leroy.

Livingston—J. B. Hall, Samuel Gardner, Genesee.

Monroe—John Watts, Wm. E. Lathrop, Rochester.

Orleans—Wm. Wood, Albion; Wm. P. Hopkins, Medina.

Otsego—J. R. Worthington, Cooperstown.

Herkimer—Ezekiel Morris, Wm. Lomis, Little Falls.

Resolved, That the Central Committee be requested to fill all vacancies in the several county committees.

The Committee on Address and Resolutions made their report, which was accepted. The Address and Resolutions being read, were unanimously approved and adopted.

Resolved, That a Finance Committee be appointed to provide means to defray the expense of publication; whereupon a committee was appointed.

Adjourned till 2 o'clock.

AFTERNOON SESSION.

August 21, 1834.

The finance committee reported that each member of the Convention pay one dollar to defray expenses. The report was unanimously adopted.

It was then

Resolved, That the President of this Convention be Treasurer of the same.

Resolved, That the Central Committee be instructed to have printed any number that they may deem proper of the Address and Resolutions, not less than 5000 copies.

Resolved, That the several corresponding committees of counties that have been appointed, be requested to take measures to ensure the appointment of corresponding committees in counties adjacent to theirs, as soon as possible after their return home, and have their names sent on to the Central Committee at Utica.

Resolved, That the names and occupations of the delegates present be annexed to the Address and Resolutions.

Resolved, That the resolutions lying on the table, not acted upon, be considered as withdrawn.

Resolved, That the Central Committee be instructed to furnish to each member of the next Legislature, and the Governor, a copy of the proceedings of this Convention.

Resolved, That the communication of Judge Morse, and all other communications, be referred to the Central Committee.

A vote of thanks was then passed to the Select Committee of the Assembly of this State, of which the Hon. Charles Humphrey was chairman: also, to the Mechanics' Association of Utica, for the tender of the use of their Reading Room and other civilities to members of the Convention during their stay in the city; and also, to the venerable President and other officers, for the satisfactory manner in which they have performed the duties devolving on them.

The convention then adjourned at 4 P. M.

(Signed,)

RUDOLPH SNYDER, President.

ANSON BAKER, FREDERICK STARR, } Vice Pres'ts.

ROBERT TAYLOR, R. HOGARTH, } Secretaries.

August 21, 1834.

ADDRESS AND RESOLUTIONS.

The Convention of Delegates, from the several counties of the State of New-York, assembled at Utica, on the 20th day of August, 1834, have candidly, deliberately, and extensively examined the present *State Prison system* of this State, and submit the following as the result of their investigation:

The system of employing the convicts in our prisons, at mechanical branches, (as at present pursued in this and several other States,) does not accomplish either of the objects had in view by those who established and approved of our criminal code. Laws were established for the *punishment* and *prevention* of crime, and the reformation of the criminal; when, therefore, the property of individuals has been plundered—when the incendiary has fired the building of his neighbor—when the seducer and the ravisher have committed crimes disgraceful and disgusting to human nature—and when the ruffian has deprived his fellow-being of life—justice demands that the punishment of persons committing such offences should be commensurate with their crimes. The safety and happiness of the community require that the punishment should be of such a nature as to deter released criminals, and others, from committing crime. Does the present prison system of this State accomplish either of those objects? We answer No! and will now endeavor to prove, by reason, and the testimony of competent witnesses, that the present system does not inflict sufficient punishment—has but little tendency to prevent crime, or reform criminals—that it imposes an unjust and pernicious tax on mechanics, and is degrading to their character.

1. *The present Prison System of this State does not inflict sufficient punishment for crime.* Imagine a case, (and there are many such,) of a man whose debauchery and crime have

enfeebled his body, impaired his constitution, and prostrated the faculties of his mind, until he is unfit for business, and therefore prepared to drink the dregs of the intoxicating cup, and to commit depredations upon his honest neighbor. In this stage of his existence, the emaciated, loathsome, and guilty wretch is apprehended, committed, convicted of crime, and sent to the State Prison to be *punished*. Now, fellow-citizens, prepare yourselves for the melancholy, heart-rending tale of the *punishment* of this being, who has for a series of years stifled the convictions of conscience, and grossly violated the laws of his God and his country. *Thus* is he punished: Arrived at prison, a physician attends him; medicine is administered; he is furnished with wholesome food and comfortable clothing; by degrees he recovers; he learns a trade; (perhaps he is released before the term for which he was sentenced has expired,) and comes out of prison a sound man. Now we ask, during what portion of the time he was imprisoned was he *punished?* Did the physician punish him by restoring him to health? Was wholesome food and comfortable clothing, (without any anxiety on his part to procure them,) a *punishment* to him? If so, would to heaven every honest mechanic might be *punished!* then they would have (what they cannot always procure by honest industry) a physician when there is need—food and clothing at all times. Talk of *punishment!* Look at the poor, honest, but unfortunate debtor in prison; contrast his situation with that of the convict in your state prisons, and you will, you *must*, admit, that the situation of the debtor is far less comfortable than that of the criminal. It may be said that an extraordinary case has been cited. We reply—select any case you please, and you cannot make it appear that the system is what it should be—that it is what it pretends to be. No! "From a mistaken philanthropy, the system of our prison discipline has been so mellowed down, that our prisons ought to be now considered as asylums for the unfortunate, rather than places of punishment for the guilty; and it may be fairly presumed, that, in many cases, their inmates enjoy what they never did before—a comfortable home; and instances have not been wanting, in which those whose term of service had expired, have committed new crimes for the express purpose of being able to return to these homes." And it may be safely asserted, that the situation of criminals in our State prisons is no worse than that of persons barely *suspected* of crime, or the inmates of our county poor-houses, whose only crime may be poverty or disease. We conclude our remarks on the *punishment* inflicted, with a quotation from the Report of the Hon. Charles Humphrey, made to the Assembly of this State at its last session. "It is worthy of observation," says Mr. Humphrey, "that in most instances, both in the old world and in the new, the criminal codes have been gradually assuming a character less sanguinary, and less severe. The latter observation is undoubtedly applicable to this state; and it is a serious matter of inquiry with some of our most enlightened citizens, whether the indulgence of a supposed feeling of humanity, on the part of many, has not degenerated into a morbid sensibility, that would consult the interest and well being of the criminal, at the expense of the community against whose rights he has offended. The idea of coupling rewards and immunities with punishment has, in some instances, found its way into our statute books. It is, in the estimation of your committee, of a doubtful policy. It is questionable whether every indulgence to a convict, beyond a mere wholesome supply of his natural wants, is not *detracting* so much from the efficacy of his punishment."

2. The present system has but little tendency to prevent crime, or reform criminals. It is a well known fact, that the prisoners lay plans, (nor can they be prevented, while suffered to work together,) and make arrangements for future depredations; they can at times converse together; they can, and do, give the significant look, the informing nod, the knowledge-conveying wink, the assenting bow; and instances are not wanting to prove, that many agreements made in prison have resulted in loss of property to honest men, after the prisoners have been released. The records of every criminal court in our State show that crime is increasing; and that many persons are sentenced to our State prisons who have been inmates of the same prison before; some of them two, others three, and others four times. Talk of reform! Hear what the Honorable Richard Riker, Recorder of the city of New-York, has said on this subject: "There are not more than two, out of an *hundred*, of well attested instances of reform. At every court of the General and Special Sessions held in our city, with few exceptions, several old offenders, who have been before sent to our penitentiary, or State prison, or to the State prison of some other State, are again tried and convicted."

Mr. Humphrey, in his Report, says, "The fact may be alluded to, that most of our State prison convicts are originally dishonest and

unprincipled men, destitute of a sense of moral rectitude; and that therefore in many, if not most instances, discharged prisoners, even if not compelled by necessity, will from choice resume their practices of depredating upon society. This fact is abundantly proved, by the vast number of instances in which these men are found a second, and even a third time, the tenants of the same, or of some other prison."

3. The present system imposes an unjust and enormous tax on mechanics, and is degrading to their character. It is said, that none of the citizens of the State are taxed for the support of prisoners: "the prisons support themselves." It is true, that mechanics are not called on to pay money to defray the expenses of the prisons; but articles manufactured in the prisons are sold in almost every city, town, and village, in the State, at prices from 40 to 60 per cent. below what the honest mechanic, *who supports himself and family*, can afford them for; and the consequence is, that hundreds of mechanics are thrown out of employ, and, in many cases, their families are reduced to beggary. This is no picture of the imagination. No! it is a melancholy solemn fact. The State government, to which we look for, from which we have a right to expect, and whose duty it is to afford, protection to the interest of the virtuous and industrious mechanic: that government, which, had it acted justly, would have acted according to the truly republican maxim—"for the greatest good to the greatest number,"—either from mistaken views of economy, an unwillingness to suspend the operation of a favorite theory, or want of that information which experience and observation have now finished, rather than intentional injustice, has compelled the mechanics of the State to bear all the burthen of State prison expenses, and suffer the loss of the many thousands of dollars which now go into the pockets of the hordes of State prison contractors, agents, and sub-agents. Shall we be impudently told, that the power which should protect us has a right to destroy us?—that it is just to impose on *mechanics* a prison system calculated to drive them to desperation, crime, and beggary, to exonerate the people from equal taxation, and to preserve untouched the public treasury? But, fellow-mechanics, you not only suffer in a pecuniary point of view: your character is degraded. Many branches of mechanical business being carried on in the prisons, the moment a journeyman offers himself for work in a place where he is not known, he is subjected to "humiliating and degrading inquiries and comparisons," and "to a scrutiny which an honorable man could not be expected patiently to endure." Here again we refer to the able Report of Mr. Humphrey, in which he says, "If it (the prison system) does not actually break up the establishment of the citizen, it compels him to labor for a bare subsistence; and it is not to be wondered at, if blighted prospects and disappointed hopes have, in the end, a deleterious effect upon the habits and morals of a discouraged and despondingman." Again, "State prison convicts are, in most instances, men destitute of capital; if, therefore, they attempt to pursue without, the trade they have acquired within the prison walls, it must be in the capacity of journeymen; and they must, consequently, if employed at all, labor side by side with honest and respectable mechanics. When honest men associate with rogues, the very connection reduces the character of the former down to the standard of the latter; it can never have the effect of raising the reputation of the rogue to that of the honest man, in the estimation of the world. Suppose a respectable farmer or other citizen should send his son to some mechanic to learn a trade, and on visiting him at his workshop should find him seated by the side of a discharged convict: might he not justly complain? Would an honorable minded man, under any circumstances, consent that his son should be subjected to the contaminating influence of such an association? His faith in the reformation scheme must be strong indeed, who would hazard the morals of his son in such company."

The contempt and degradation necessary and consequent on a competition between our virtuous citizens and condemned criminals, is a subject we would fain have passed in silence; but it is the most disgusting feature of the system. If asked, what remedy we propose for the evils we complain of, we might answer, that the evil once fully admitted, the collective wisdom of our statesmen will easily provide that remedy, without resorting again to any of those sanguinary modes of punishment which the penitentiary system was intended to supersede. Solitary confinement, for a shorter period of time than the usual term of imprisonment, with an entire abandonment of the practice of pardoning or reprieving, is the plan which seems, in our opinion, the best calculated to produce the desired effect. Or, if the labor system must be continued, which we by no means desire, the convicts may be employed in the construction of roads, canals, or other public works, which,

while they contribute to the general benefit of the whole community, will not operate as an unjust and unequal tax upon a part. But we will not attempt an elaborate view of this part of the subject; the necessary limits of this address precludes the possibility of doing more than thus briefly to allude to some of the most prominent and feasible plans which have been proposed.

Fellow Mechanics of the State of New-York, we call on you as men, as citizens, and as mechanics, to assert, demand, and maintain your rights. Too long have your usefulness and influence in society been neglected; too long have you suffered under the present unjust, injurious, and blighting prison system. Arise, therefore, in your might, and, through the ballot boxes, speak a language *not to be misunderstood.* Select men who, to whatever *political* party they may belong, will use their best exertions to destroy this *Hydra of Iniquity;* men who, while they provide for the punishment and reformation of criminals, will at the same time guard and secure the rights of the honest and industrious citizen. We are not unreasonable in our demands; we ask only for justice; and we are satisfied that, when the evils that result from this system, and of which we complain, are known, all classes of society will see and admit the justness of our claim, and we shall obtain redress.

We also call especially upon the *agricultural* part of the community, to step forward and aid us in remedying this evil. They are alike interested with us in sustaining the industrious mechanics of the country, who compose, with the farmers, the *bone and sinew* of the community. They are alike dependent upon the mechanic, as the mechanic upon the farmer. If, therefore, the mechanics are prostrated by this, to them, *ruinous* course of measures, will not the farmers be prostrated also? If the mechanics are driven to agricultural pursuits, is it not easy to perceive that the loss which will be sustained by the farmer, in the reduced price of his produce, and the diminished value of his real estate, will exceed, by an hundred fold, the paltry sum which he may save in the price of articles manufactured by *state prison convicts*? Is it not, therefore, we again repeat, as much for the interest of the farmer, as of the mechanic, that all improper interference with regular business should be avoided? *We* think it *is*; and with this belief, we confidently call upon every farmer to aid us in electing such men as will protect *our* rights and *their* rights. To our fellow citizens of other professions, we would appeal in the language of the Hon N. B. Morse, judge of the Criminal Court in Kings county, who says:

"The rule, that 'we should do unto others as we would that others should do unto us,' is one of the soundest morality; and the oftener it shall be inculcated, and the more it shall be acted upon, the more elevated and honorable will be the tone of public sentiment.

With this rule of moral honesty before them, let the question be put to men of wealth, ease, and affluence, whether they would like to have the State prison turned into a school, where the convict should be taught the elegant accomplishments of fashionable life, that, on his return to society, he may be qualified to mingle in the drawing room with *their* sons and *their* daughters, and perchance to improve his condition by marriage with an heiress of their fortune?

Let the man of wealth say, whether he would be willing to receive the convict as the dancing or music master for his sons or his daughters? Let him say, even, whether he would receive him as his cook or his coachman, however well he may have learned these ornamental or useful arts in the State prison?

Let the lawyer, the divine, or the physician, say, whether accomplished lecturers in the learned professions ought to be procured for the prison, to supply the world from such a seminary with the men who are to watch over the rights and property of men—to enlighten the morals, and prepare their souls for a better world—or who are to remove the physical maladies of our nature?

Let the merchant say, whether the convicts should be taught book-keeping, and the various other branches which are to fit them for the counting room or the counter, to be sent back for employment to the mercantile community; whether he would like to trust his keys, his books, or his goods, to such men; whether he would consider the educated convict as a suitable companion for his sons or his clerks?

An affirmative answer to these questions would be revolting to the moral sense of the community. Then wherefore inflict upon mechanics that which, when applied to ourselves, would not only raise the sigh of regret, but would arouse our utmost resentment? Surely, the justice of the community cannot be appealed to in vain.

The universal consent of mankind has long conceded to the mechanics and farmers that 'they are the bone and sinew of the community.' And it is no less true, that no whole class of the people, in towns and vil-

lages, combine a greater share of intelligence, morality and patriotism, than the mechanics; probably by no means an equal share. And if the wealthy and the learned are not to be thrown in contact with the criminal from the State prison, why, by what rule or right, should the mechanic?

The first and more obvious evil is, that the labor of the convicted villain and lawless marauder is put in competition with that of the regular and honest mechanic. The convict is only to be supported by—barely to subsist upon—his labor; and if he does not even earn a subsistence, the public makes it up; while the mechanic with his family, who has an honest right, not only to a livelihood for himself and them, but to save from his earnings the means of education for his children, and comfort for himself in old age, is compelled to compete with this system, which rewards crime by learning the criminal a good trade, or give himself up to hopeless indolence and consequent degradation. This species of competition has been compared sometimes with that between free and slave labor, which is said to be very unequal, but which is far more advantageous to the free than this competition to the mechanic, for the slave is to be supported both in helpless infancy and declining age; whereas, the convict usually both commences and ends his labor as an apprentice or journeyman to the State, in the prime and vigor of manhood.

The next, the more dangerous and degrading evil of the system—more dangerous for being more secret and insidious—is, that when these well-instructed mechanic convicts are released from their service to the State, they are enabled to seek employment in the work-shops of the regular mechanic, and there taint the morals of those who are training for honorable and useful life, or cover the most enormous offences with an industrious application to business, and seeming honesty of deportment. The people of Brooklyn have witnessed a near, if not an exact parallel to the latter case, in the course of the notorious Smith, who afterwards robbed the City Bank of New-York.

Will not every class of men arise upon this subject, and aid the mechanic in his endeavors to obtain redress? Let it not be said that the mechanics are left to contend for justice upon this subject alone, but let the spontaneous voice of the whole community call for the requisite reformation. Let all act upon the glorious rule, that 'as we would others should do unto us, even so will we do unto them.'"

We call on every citizen of the State, whether mechanic, agriculturist, professional —or be his situation or occupation what it may,—to come forward and assist us in the struggle for the destruction of the detestable monopoly of which we complain. We ask, is not a community of hardy and virtuous citizens preferable, to the State, to one of convicts and paupers? We are sensible you will answer in the affirmative; and we therefore confidently appeal to you to adopt and support the following resolutions:

Resolved, That the system pursued at present in our prisons is an infringement of the rights, and an insult to the feelings, of the mechanics of our State; that their rights are trampled on, and their character degraded, by competition with this infamous monopoly of convicts and malefactors.

Resolved, That this system of oppression is of such a nature as ought not quietly to be borne by any set of people worthy the name of freemen.

Resolved, That the object of all just government and righteous laws should be the protection of the virtuous in their lawful occupations, and to punish, and endeavor to reform, the vices of the guilty.

Resolved, That the present prison system operates as a punishment to the virtuous, as a premium for crime, and a reward to the guilty.

Resolved, That we recommend to all our brother mechanics, of every trade, that, at the coming and all future elections of members of the Legislature, they vote for and support those and those only who will oppose this monopoly; that to such we will give our whole influence, and that we will use all honorable means to promote their election.

Resolved, That the mechanics in every city, town, village and hamlet, in our State, be requested to form themselves into associations, in support of the above views, and in opposition to the present prison system.

Resolved, That we will pursue this subject with unabated zeal and untiring perseverance, till justice be accorded to our claims; and we recommend that a Convention be annually appointed, to meet at Utica on the third Wednesday of August in each year, until we obtain redress: the delegates to be chosen from every county in the State, in a ratio of triple the number of members to the Assembly of the State.

NAMES OF DELEGATES, &c.

NEW-YORK.

Anson Baker, Silver Plater.
Joseph N. Barnes, Marble Cutter.

Joseph P. Simpson, Tin Plate Maker.
Paulus Hedl, Blacksmith.
Robert Taylor, Cooper.
William Hall, Piano Forte Maker.
Austin Baldwin, Plane Maker.
John Waydell, Cooper.
Jacob Day, Lock Smith.
Cornelius S. Van Winkle, Printer.
Alexander Masterton, Stone Cutter.
John Anderson, Stone Cutter.
Edward Smylie, Brass Founder.
Daniel C. Pentz, Cooper.
Thomas Simms, Hatter.
Daniel Berrien, Brush Maker.
Joseph Oatwell, Marble Cutter.
D. K. Minor, Printer and Publisher.
Stephen Kingsland, Builder.
William Eagleson, Marble Cutter.

KINGS COUNTY.

David Anderson, Brooklyn, Stone Cutter.
William McDonald, do. Cooper.
Daniel S. Burdett, do. Comb Maker.
Samuel S. Powell, do. Tailor

RENSSELAER COUNTY.

E. J. Willet, Lansingburgh, Cordwainer.
Lyman Garfield, Troy, Cordwainer.
Arthur Millikin, do. Blacksmith.
Elias Ross, do. Silver Plate Maker.
Uri Gilbert, do. Coach Maker.
Harvey Warner, do. Builder.
Richard Freeman, do. Mason.

ALBANY COUNTY.

John Meads, Albany, Cabinet Maker.
Alexander Gray, do. Stone Cutter.
William Hawe, do. Cooper.
Wynant Crannell, do. Tailor.
Jeremiah Osborn, do. Cordwainer.
Lemuel L. Steele, do. Brush Maker.
Lewis Farnham, do. Carpenter.
Corns. Vanderbelt do. Coach Maker.
John Iggott, do. Tin Plate Worker.
David Benson, do. Plane Maker.

SARATOGA COUNTY.

Robert M. Harrington, Saddle and Harness Maker.
Nathan D. Sherwood, Hatter.

TIOGA COUNTY.

Francis Collingwood, Elmira, Silversmith.
William R. Judson, do. Saddler.
S. J. Leach, Owego, Watch Maker.
Gideon O. Chace, do. Cabinet Maker.

SCHENECTADY COUNTY.

Richard M. Cook, Schenectady, Tailor.
Stephen Traux, do. Cordwainer.
John O. Comstock, do. Hatter.
Joseph Stillman, do. Machinist.

ONEIDA COUNTY.

Alfred Munson, Utica, Burr Stone Manufacturer.
Ephraim Hart, do. Iron Founder.
Rudolph Snyder, do. Cabinet Maker.
John Reed, do. Plane Maker.
Augustus Hurlburt, do. Chair Maker.
Elisha Wells, do. Cordwainer.
Edmund W. Blake, do. Tailor.
Joshua Hardway, do. Saddler.
George Tharp, do. Silver Plater.
Elijah W. Roundey, do. Cooper.
Samuel A. Sibley, do. Coppersmith.
John S. Peckham, do. Plough Maker.
Harry Bushnell, do. Blacksmith.
John A. Russ, do. Carpenter.
Isaac G. Stratton, New-Hartford, Cabinet Maker.
Harvey Bingham, do. Waggon Maker.
Arden Seymour, Rome, Potter.
Nathan Lawton, do. Coach Maker.
Thomas Williams, Vernon, Tanner and Currier.

ONONDAGA COUNTY.

Jacob W. Page, Elbridge, Cabinet and Chair Maker.
Charles Rust, Syracuse, Cabinet and Chair Maker.
Silas Ames, do Saddler.
J. J. Wood, do. Tailor.
J. J. Bradley, do. Blacksmith.
Warren Hecox, Skeneateles, Tanner and Cordwainer.
John S. Coonley, Jamesville, Carpenter.

CAYUGA COUNTY.

John Richardson, Auburn, Cabinet Maker.
Solomon C. Dunning, do. Tailor.
Harvey Moore, do. Tailor.
Daniel Hewson, do. Tin Plate Worker.
James Snell, do. Tailor.
David B. Marvin, do. Cordwainer.
J. Litchworth, do. Saddler.

ONTARIO COUNTY.

Earl D. King, Canandaigua, Cabinet Maker.
R. Hogarth, Geneva, Tailor.

TOMPKINS COUNTY.

Thomas Thompson, Trumansburg, Cabinet Maker.
Ira Tillotson, Ithaca, Builder.
Edward Mead, do. Watch Maker.
Caleb P. Plumb, do. Cordwainer.
Almanzer Tufts, do. Tailor.

WAYNE COUNTY.

Farnham White, Lyons, Chair Maker.
Erastus Burt, Newark, Iron Founder.

MONROE COUNTY.

W. E. Lathrop, Rochester, Saddler.
Frederick Starr, do. Cabinet Maker.
Bill Colby, do. Chair Maker.

YATES COUNTY.

Samuel F. Curtis, Penn Yan, Chair Maker.
Lewis S. Ayres, do. Hatter.

ERIE COUNTY.

Abner Cutler, Buffalo, Cabinet Maker.

The following letter from the absent members of the Buffalo Delegation is so much in accordance with the views expressed by members of the Convention from other parts of the State, who were also prevented from attending, that it is deemed proper to publish it by way of

showing that similar sentiments are entertained in every section of the State, even where there has been no interchange of opinion.

BUFFALO, August 18, 1834.

Sir,—At a numerous meeting of the Mechanics of this city, held on the 8th instant, the undersigned were appointed delegates to attend the Convention to be holden at Utica, on the 20th; but owing to circumstances unforeseen, and entirely beyond their control, the delegates, with one or two exceptions, are unable to attend. The cholera, which, within a few days has assumed an alarming character, is raging with a degree of mortality greater than at any former period, calling for the kind sympathies and active exertions of our citizens, in relieving the wants, and in administering to the necessities of the distressed and the dying. No ordinary circumstances would have prevented any member of the delegation from attending.

The mechanics of this city feel a deep interest in the subject of our present State Prison system; they consider it *wrong in principle, and ruinous in its results.* They conceive that it does not, in fact, accomplish what has been claimed for it by its advocates, much less what was designed by its founders.

Instead of supporting itself, and bringing a revenue to the State, it in effect levies a most enormous and oppressive tax upon mechanics only, while it exempts all other classes of citizens. Instead of reforming criminals and returning them to society, fit associates for our families, it makes them greater adepts in villainy, and better qualified to impose upon the honest and unsuspecting. It, in fact, makes the accomplished *scoundrels licensed* to go forth and depredate upon community, destined in ninety-eight cases out of one hundred* to again become tenants of the same, or some other prison.

These are not all the evils of the system; it has a direct tendency to depress the value of labor, and to bring it into disrepute, to the injury of the *many*, for the benefit of the *few*.

If the moral sense of community will tolerate the system as now conducted, a little more refinement of philanthropy may abolish our prison work-shops, and convert them into seminaries of learning, into law schools, medical colleges, and theological institutions, for the benefit of *gentlemen convicts*.

In view of all the facts we have been able to collect on this subject, we are decidedly of opinion that the whole system is *defective;*

That it is a most oppressive *tax* upon the mechanics of the State;

That it is destructive of the morals of society;

That it has no tendency *whatever* to reform criminals;

That it is a disgrace and stigma upon the mechanics of this State, and *opposed to the spirit of our institutions;* and we believe the subject only needs rightly to be understood by the intelligent people of this State, to meet their decided disapprobation and rebuke.

* See answer of the Hon. Richard Riker, to questions of the Select Committee, made 1834.

With a view of this object, we pledge ourselves to co-operate with our brother mechanics throughout the State, in taking such measures as shall be recommended by the Convention; and we will most cheerfully perform any duty assigned to us, or either of us, in furtherance of the general object.

E. D. EFNER,
JOHN W. BEALS,
WM. KETCHUM,
A. W. WILGUS.

Absent Members of Buffalo Delegation.

To the President of the Mechanics' Convention, Utica.

[We have obtained much information on the subject of "State Prison Labor:" it will be found at page 148, as well as other interesting facts connected with this subject.—ED. M. M.]

Apparatus for extracting Caloric by Compression for heating Rooms.

To the Editor of the Mechanics' Magazine:

SIR,—It appears to me most probable that some plan has heretofore been adopted, or proposed, for extracting caloric by compression for heating rooms, &c. I can only say that I have no knowledge of any instance of the kind, nor have I made any experiments on the subject, except on a very small scale, which however have been very satisfactory. I intend, soon as convenient, to construct an apparatus of the following description:

A cylinder six feet long and six inches in diameter, with a permanent partition or cylinder-head in the middle, dividing the interior into two equal parts. In each part of the cylinder is a piston with packing and piston rod, with cross-head and guides, as is usual in steam engines. The two cross-heads are connected with each other by two rods, which extend from the two ends of one cross-head to those of the other, and of such a length that when one piston approaches the centre-head, the other recedes to the opposite end of the cylinder. On one side of the cylinder, and near the centre-head, is a branch, and within the branch a puppet valve, which admits the induction of air, but prevents its escape. On the other side, opposite the first, is a second branch and valve, which permits the air to escape from the first section of the cylinder, but prevents its return. These valves are drawn to their respective seats by spiral springs. Near the second branch, but communicating with the other section of the cylinder, is a third branch, with a cock-valve. From the head of this valve a crank or lever projects horizontally about three inches towards the cylinder. To the end of this lever is attached, by a revit or moveable joint, a rod, which

extends to the end of the cylinder, having a hook or catch near the end, which takes to the second cross-head, whenever the second piston is brought forward to the centre-head; and is thereby, when the piston recedes, carried about three inches, thus opening the valve, and is then detached from the cross-head by means of an inclined projection on the lower side of the rod coming in contact with a pin, which for this purpose projects from the end of the cylinder, and the valve is then instantly closed by a spring. Opposite the third branch is a fourth, with cock-valve, lever, and rod; this rod also extends to the end of the cylinder, and the end being bent backward comes within; so that when the second piston approaches the end of the cylinder, it comes in contact with the bent end of the rod, moves it two or three inches, and thus opens the valve: the rod is again brought back to its first position, thus closing the valve by the approach of the cross-head.

To the first branch is attached a pipe, which conducts air to the first section of the cylinder from without: to the second is attached a pipe, which receives the compressed air from the cylinder. This pipe communicates with another, being connected by a flanch or other joint, and having a valve near the joint, which admits the compressed air to the second pipe, but prevents its return. In the same manner the second pipe communicates with a third, and that with a fourth, the order thus extending through any number of pipes, of any convenient dimensions, and any variety of positions, with joints and valves. These are called heating pipes, the last of which communicates with the second section of the cylinder by the third branch. Another pipe is attached to the fourth branch, which conducts the liberated air out of the room.

These pistons are put in motion by wind, water, or other power, the third valve being kept closed, and the fourth being kept open, (which may be done by raising the two rods connected with these valves a little out of their usual positions,) till the air within the heating pipes becomes compressed equal to about twelve atmospheres, when the two rods, being returned to their places, are put in operation. By this arrangement it will be understood that the pistons, being connected, and the expansive force of a portion of the compressed air being applied to the piston, it contributes much, if not most, of the power required for compressing it. Note—In the foregoing description, the cylinder is supposed to be fixed in a horizontal position, but may be either horizontal or vertical, as may be most convenient.

I have not yet had opportunity of ascertaining by experiment what quantity of heat may be thus obtained; but I think I may safely calculate, that about three-fourths of the caloric contained in the air thus compressed will be evolved during its progress through the heating pipes; and that the atmosphere contains at least one hundred degrees of caloric when at the temperature of zero: therefore, if the piston makes one hundred vibrations per minute, and compresses at each one cubic foot of air, it follows that the temperature of the air contained in a room ten feet square may be raised seventy-five degrees in ten minutes; or twenty-four rooms may be kept comfortably warm in the coldest weather. The liberated air must not be permitted to escape within the room, as it will be intensely cold, and might be employed to advantage in the preparation of ices, or in cooling apartments in warm weather. Yours, very respectfully,

RUFUS PORTER.

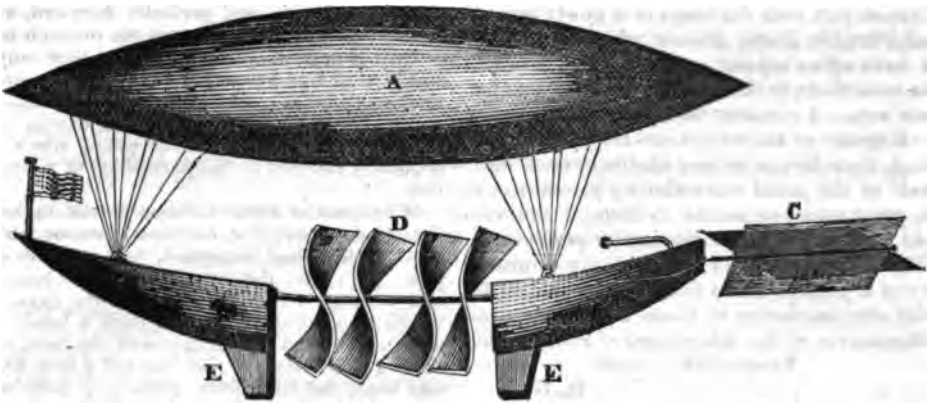
Billerica, Mass., Aug. 16, 1834.

Æronautic Steam Car.

To the Editor of the Mechanics' Magazine:

SIR,—Herewith I send you a proposed plan for an Æronautic Steam Car, which, if you deem worthy of your attention, you may record in your Register of Inventions and Improvements. Of the expediency of the project, your readers and yourself must be the judges. For my own part I should not have thrust it upon your attention had I the slightest thought of its inexpediency. I am of the opinion that, if properly constructed, it will succeed beyond a doubt in calm weather. Of the effect that would be produced, should Æolus unpack his chariot during one of its aerial flights, I am unable to speak; but I presume the tempest-tossed voyager would be able to conduct his frail bark with as much skill certainly as our modern aeronauts, who are limited in their operations to a discharge of gas and ballast. The plan herein proposed occurred to me some years since, but I have not availed myself of the advantages that arise from an actual experiment, because of the expense which must necessarily be incurred in the construction of such a machine.

The sketch represents a side view of the car. A is a balloon; B, the car attached thereto; C, a helm to govern its course; D, spiral vanes; E, supports for the car when at rest. Let two balloons, of the form represented in the drawing, be made of silk, prepared in the usual manner, both of the same size. A silk netting is thrown over each one, but is collected into a few cords



at a short distance from each extremity of the balloon. The balloons being placed horizontally and parallel with each other, a car is suspended a few feet below, in the manner represented in the sketch, being attached at four points. The car may be made of any desirable form, of some material combining in an eminent degree strength and lightness. A light frame of wicker-work covered with oiled silk might answer the purpose. The car contains,

1. A simple apparatus for generating hydrogen gas, suitably connected with the balloons by pipes. Valves are also provided for the intromission and eduction of the gas at the disposal of the æronaut. If it is required to ascend, a greater quantity of gas is introduced, the balloons being constructed so as to admit of it. A contrary process causes a descent. The usual way of effecting a rise by throwing out ballast is therefore wholly avoided, and the car is not encumbered by unnecessary baggage.

2. A small steam engine of the simplest construction, with gearing to move the silken vanes or wings, of a spiral form, which are placed on both sides of the car. The boiler may be heated by the combustion of water in combination with bituminous or oleaginous substances, on the principle of "Morey's American Water-Burner."

3. A helm of silk stretched on rods placed in the stern, to govern the motions of the whole. This may be made after the manner represented in the drawing, where two fans are joined together at right angles with each other, (its action on the air will readily be perceived,) or by two distinct fans, placed so as to act vertically or laterally.

4. A barometer, thermometer, compass, and the whole et cetera necessary for an aerial voyage.

Let us now suppose the balloons to be inflated, and the whole with one person buoyant in the air, the balloons being of sufficient capacity to sustain the whole. Gas is now introduced till it rises. When a sufficient height is attained let the silken vanes be caused to revolve with rapidity. *A rapid progressive motion* is the result. Should any of your readers think differently, or should they discover any difficulty, theoretical or practical, they will please make it known through your columns, that I may avail myself of the same medium (with your permission) to correct, acknowledge, or explain, as the case may be, as I hold myself in readiness to answer all queries respecting the above, if possible; and I am equally ready to confess my error, if it shall be clearly shown. Its practicability rests upon the truth of two points: 1. Can balloons be constructed of sufficient buoyancy to support a car containing the above described apparatus? 2. If supported, will a progressive motion be caused by the action of the spiral vanes on the air? When we reflect that balloons have been made capable of raising four persons, and that the apparatus cannot exceed the weight of two persons, the truth of the first of these propositions becomes sufficiently apparent. That the air is a sufficient abutment to cause progressive motion, if acted upon properly, is exemplified in the flight of birds, where muscular action is exerted to acquire and maintain a height, as well as to move forwards. The words of poetry as quoted in your last will be strictly verified:

> "Soon shall thy arm, unconquered steam! afar
> Drag the slow barge, or drive the rapid car;
> Or, on wide moving wings, expanded, bear
> The flying chariots through the fields of air."

In conclusion, Mr. Editor, I would beg you to overlook the many errors that must occur in this article. "I am no orator, as Brutus is," and am equally unskilled in "chaining winged thoughts to the parchment." At some future time I purpose to

furnish you with drawings of a newly invented Portable Horse Power which I possess. I have other objects in view besides a desire to contribute to the advancement of mechanic arts. I consider that yours is indeed a "Register of Inventions and Improvements," and, therefore, a person unable to avail himself of the usual protection by patent may in a great measure secure to himself the *credit*, at least, of his invention by publication. The world may then judge of the originality of a project, and a fair copy be present for the *accommodation* of those who would avail themselves of the *advantages* of *re-invention*.

Respectfully, yours,

B. G. N.

Dexter, Mich. Ter., August, 1834.

PLANARIÆ.—On January the 27th, at the Royal Institution, Mr. Faraday proceeded to lay before the literati assembled, an account of Dr. R. Johnson's investigations into the *restorative*, *productive*, and *reproductive* powers of the Planariæ, a genus of small animals allied to the leech, and of which there are several known species, viz., P. torva, lactea, hastata, arethusa, felina, &c., the three first of which are to be found abundantly in a pond near the Red-House, Battersea Fields.

From Dr. Johnson's experiments, it appears that if an incision be made longitudinally into the head of the animal, so as to separate its eyes from each other, if the cut has not been carried very far down, it will heal in the ordinary manner; but if the head be absolutely cleft in twain, then, according to the extent of the fissure, there will be a mass of new matter formed by each half of the head, which will either join the two halves together, forming a head of extraordinary size, and bearing in it one or two additional eyes, or each old half, thus cleft, will form the new matter into another half, with an eye, and so the animal have two complete and entire heads. If the fissure be farther down through the body of the animal, then not only will there be two heads, but two bodies also formed, joined together only by the tail; and when this is the case, so little unanimity does there exist between these *siamoid* twin-planariæ, that they never pull or swim the same way; and so violent are their efforts, that they frequently, in the course of two or three days, tear the only remaining bond of union, their tail, in sunder, and then two distinct and perfect animals result.

If in a common planaria the head be cut entirely off, a new head will be formed; and if its lower extremity be removed, it will produce a new tail. In a planaria, which, by the operation above described, had been invested with two heads, these "nova capita" were successively severed for three several generations, and were immediately and perfectly renewed, and subsequently the animal was cut through just below the artificial bifurcation, and then only a single head was produced, so that in this more simple "capital" operation, a single headed animal became a biceps, and, after having had the use of six heads in succession, was subsequently reduced to the possession of a single one.

When one of these animals is cut in half, the head, or anterior extremity, swims away as if nothing had happened, and speedily retails itself; but the tail swims to the bottom, and remains torpid for two or three days, by which time it has formed for itself a head. If a planaria be cut into three pieces, the head will form a new body and tail, the tail a new body and head, and the middle section or body will produce both head and tail. If a quarter be removed by making a longitudinal incision through the head, and half down the body, and then a semi-transverse cut to remove the upper quarter, not only will the three remaining quarters speedily re-produce a new fourth, but also the separated fourth will form to itself three new quarters. Indeed, a planaria has been cut into as many as ten pieces, and each piece has become an entire and perfect animal. In fact, this mode of propagation, which physiologists artificially institute, seems to be frequently resorted to by the animal itself. The planaria felina has been seen to throw off pieces of its body, to form new animals, and these are not diseased but healthy parts, and not only parts of its tail, but often offsets from its sides, &c. Indeed, the planaria felina, and p. arethusa, have been never known to lay eggs, whilst the torva, lactea, &c. lay them in abundance, both the original animals and those artificially produced. It would seem that those species which inhabit springs and running waters, propagate only by division; but those which dwell in ponds and ditches, where the water is occasionally exhausted, are oviparous, as well as viviparous.

The above facts are physiologically curious, as they show a still closer affinity than had been previously supposed to exist between the propagation of plants and animals by cuttings as well as seeds; for they have shown that this mode of propagation can be carried to an almost equal extent in the one as in the other—an extent to which the experiments of Trembley, and others, on polypi, star fish, &c., did not reach.—[Medical and Surgical Journal.]

INTERCOURSE WITH THE WORLD.—Increasing our connections with mankind is like an extended line of an army, vulnerable at many points, and liable to be broken and discomfited. If we concentrate and incastellate our forces, we may, indeed, remain undisturbed, and we may also lose all in a coup-de-main. Alas! how dark is the ken of human foresight.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. Minor and J. E. CHALLIS, at No. 25 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum in *advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING SEPTEMBER 13, 1834. [NUMBER 2.

STATE PRISON LABOR.

In "AMERICA," the asylum of the oppressed of all countries, the nation that has dared to declare itself "free and independent" of the whole world, where equal rights are advocated, and those who gain an honest livelihood by their industry are as much respected as the man of the greatest wealth, it is a most extraordinary fact, that the system of our criminal jurisprudence has been for many years, and *still is*, calculated, to make many an honest and well-meaning mechanic feel shame and disgust in consequence of the society with which he has been unconsciously brought into competition and association—associated with felons! with men who have committed some of the greatest outrages on society, and who have been nominally *punished*, but who, in fact, derive more advantage to *themselves* from that nominal punishment, than they ever gained before in the same space of time. They are taught trades of various descriptions, they are well fed,—and many cases are known where the criminal has entered the prison in a weak and debilitated state, and left it, in consequence of the excellent medical aid there afforded, in good health, and apparently possessing a robust constitution, only to mingle with our mechanics; and many instances could be stated where they have been placed in a situation to be the guide and overseer of the apprentices, and even of the children of mechanics.

It is high time that such a state of things should cease to exist, and a system adopted which shall protect honest industry from a competition with the labor of felons, whether carried on for the benefit of the State, or individual contractors; and we feel confident that it is only necessary for the mechanics, in every section of the Union, to second the exertions of the Utica Convention, and it will be done, and that speedily. We have official documents that will make it clear that the present system of *punishment* has not that salutary effect upon those who have been convicted which many have supposed; and can state several instances where men have been inmates of the same or other prisons, three, four, and five times; this we shall do in this, our present number of the Mechanics' Magazine, a work which, although only known comparatively to a few, has been patronized far beyond any work of a similar nature ever issued from the press in this country, and which will ever be found advocating the interests of the *working men*, and its columns always open for their communications on any subject (*except politics*). We shall be gratified to be made the medium of communication between mechanics in different parts of the Union, and pledge them that we are devoted to their best interests; and shall do all that men with our limited means can do, to disseminate such information as will elevate the character, and improve the condition, of the mechanics of the United States; and to one measure especially do we stand pledged—never to abandon the cause *until we see the present odious State Prison Monopoly* done away, and the mechanics admitted to a full participation, in proportion to their numbers and intelligence, of the duties, stations, honors, and emoluments, of the country.

It has been well remarked by the eloquent and learned BURKE, that "no government ought to own that it exists for the purpose of checking the prosperity of its people, or that *there is such a principle involved in its policy.*" That such a principle does exist in this and other States, by allowing convicts to be employed in the various branches of mechanic arts, will, we think, be readily admitted—a system calculated in every way to deteriorate and oppress the most numerous and useful of our citizens, the artizans—to injure the industrious tradesman—to promote and encourage immorality—and to throw the great mass of our trade into the hands of large capitalists, who have the means of employing an unlimited number of hands, and are thus enabled to undersell the fair industrious man who is toiling only for a living.

"We the people" profess to govern ourselves, by deputing those to be our representatives who we believe will act in accordance with our wishes on subjects of vital importance to the community, and therefore it

has been chiefly owing to our supineness on this question, that this odious system has not long since been abolished. The recent proceedings at the Utica Convention, inserted in this number, at page 133, will show that the great mass of the working-men, and the friends of working-men, are aroused on the subject. They have suffered by its continuance, in a pecuniary view, which, together with the disgraceful associations into which they have unknowingly been introduced, by working with discharged criminals, has determined them to use all lawful means to put an end to a practice which is a disgrace to our country. If the practice of teaching the convicts some means of obtaining useful employment had the desired effect of reforming them, there might be some excuse for the continuance of such a practice; but we know the contrary is the case. In a conversation, a few days since, with the Hon. Richard Riker, the Recorder of New-York, before whom many of these men have been tried, he stated that not more than two out of every hundred that had been tried before him, and imprisoned, had returned to honest pursuits; and on referring to Mr. Humphrey's report, made to the Legislature in March, 1834, we find he has stated to the Committee that fact. We cannot do better than insert his letter—it is as follows:

"New-York, 27th March, 1834.

"GENTLEMEN—It is not in my power to reply to your several questions at as early a period as you could have wished. A press of official duties prevents it. I answer a part of them.

"To your first question, to wit: 'What portion of offenders sentenced to the penitentiary or to the state prison, as far as your experience enables you to say, reform?'

"Answer.—I regret to say, very few. My opinion is, as far as my experience enables me to give an opinion, that there are not more than *two* out of *an hundred* of well attested instances of durable reform.

"To your second question, to wit: 'What portion of offenders sentenced to the penitentiary or to the state prison, are again tried for a second offence?'

"Answer.—This question cannot, without much examination, be answered with accuracy. I can at present only say, that at every court of the general and special sessions held in our city, with few exceptions, several old offenders, who have been before sent to our penitentiary or state prison, or to the state prison of some other State, are again tried and convicted.

"To your third question, to wit: 'Can the present penitentiary and state prison system be improved?'

"Answer.—It can. On this subject there is no doubt; the manner and details may be given so as to convince every judicious man.

"To your further question, to wit: 'Can the penitentiary and state prison system be so improved as to protect the virtuous and industrious mechanic and artizan against its influence and monopoly; and, above all, against bringing felons in competition with good, dutiful, and upright citizens?'

"Answer. This question is perhaps one which ought to be addressed to the Legislature rather than to judges. My opinion is, that means can be adopted to mitigate the evil, and that means ought to be adopted to *remove* the evil altogether. The virtuous citizen should not, in any event, be reduced to the necessity of competing with a criminal. The law must be unjust that leads to such results.

"These, and the other subjects of inquiry, I will, gentlemen, if you require it, answer at a future time, fully and in detail.

"I have the honor to be, gentlemen, your obedient servant, R. RIKER.

"To Mr. AUSTIN BALDWIN, and the other Gentlemen of the Committee relative to the State Prison Monopoly."

The above letter, coming from a source better able to judge of the effect produced by attempting to reform criminals by state prison labor than any one else in the community, should have its due weight; and we do not doubt that it will.

We will now produce a few documents to show the great benefit derived by the great capitalists in contracting for prison labor, to the detriment of the working-man. We will begin with—

COOPERS.

Contract for Coopering, by Abel Wetherby, of Auburn—for 3 years, from 1833—to employ 50 convicts, viz.:

AT STATE PRISON.

2 at 50 cents per day			$1 00
9 at 30 "	"		2 70
50 at 28 "	"		14 00
3 at 12½ "	"		37½
64			$18 07½

AT REGULAR SHOPS.

Average at regular shops, 64 hands at $1 25 per day	$80 00
	18 07½
Balance in favor of contractor	$61 92½ per day.

Of the 64 hands, 9 only were coopers when sent there: of course, 55 are there learning the trade. From the above statement we see that the contract was made for 50 and that the contractor obtained the pri-

vilege of 14 more than were contracted for. Now, then, let us see the advantage accruing to the contractor by this privilege alone, granted, no doubt, by favor:

14 journeymen, at $1 25 per day	$17 50
14 convicts, at 28 cents per day	3 92
Profit on 14 hands, per day, who were not contracted for	$14 58

From the above statement, taken from official documents, it will be perceived that the profit of Mr. Wetherby, over the regular employing cooper, is $61 92½ per day. What kind of competition is this? It must be borne in mind that this is the loss of journeymen coopers. The master coopers' income, to cover shop rent, family support, and other incidental expenses, are not included; besides, interest for three months, being the credit for labor in the state prison, is also to be added.

Mr. Chichester, of Troy, has also a contract for 150 convicts at the coopering business; thus, 256 hands are employed in one branch of business, robbing the journeymen coopers of $248 32 per day, or $74,496 per year. All other trades are robbed of their rights in the same proportion. We will give the number of each trade, and beg our readers to consider the statement respecting Mr. Wetherby as a fair criterion.

At the Auburn prison the employment of convicts on the 1st of September, 1833, was as follows:

TO WORK ON CONTRACT

Bedtick weavers and spoolers	86
Shoemakers	44
Coopers	61
Hame makers	59
Tailors	38
Cabinet makers	49
Tool makers	40
Machinists	45
Comb makers	38
Clock makers	22
Coverlet weavers	25
	498

TO WORK FOR STATE.

Stone cutters	18
Weavers and spoolers	6
Blacksmiths	6
Carpenters	7
Tailors and barbers	10
Shoemakers	5
Wood sawyers and laborers	18
Soap boilers and hostler	3
Attendants in Wings	10
Cooks and washers	28
Coopers	2
Hospital nurses	2
do. sick	6
Invalids not employed	4
Masons	8
Laborers and tenders	20
Stocking weavers	3
Females	24
	163
Total	679

Convicts confined in this prison were employed on the 30th Sept., 1833, on work as follows:

AT WORK FOR SALE.

Locksmith shop	40
Blacksmith shop	37
Coopers' shop	163
Shoemakers' shop	90
Weavers and tailors' shop	18
Hatters' shop	11
Stone shops	174
Laborers in coopers' yard	22
Do. front yard	15
North and south quarries	76
	645

UNEMPLOYED OR AT WORK FOR STATE.

Blacksmith shop	19*
Shoemakers' shop	9
Weavers and tailors' shop	38
Cooks, bakers, and washers, in kitchen	18
Masons, stone cutters, and laborers at prison buildings	45
Waiters, &c. in prison hall	15
Sick and lame in hospital	20
Waiters in hospital	3
	166
Total	811

So that on Sept. 1–30, 1833, there were 1490 convicts being initiated into some method of mixing with our honest hard-working mechanics, notwithstanding we have the authority of the Recorder of the greatest city in the Union for stating, that not more than two out of each hundred ever come out without returning to their vicious propensities sooner or later! It appears, on reference to Mr. Humphrey's report, that there were discharged from Sing-Sing during the six months previous to September, 1833, ninety-nine.

Of this number, worked at some mechanical branch in prison	51
Twenty-nine had worked at mechanical business before they came to prison. Two of the discharged mechanics have returned to prison; and one pardoned on condition of going to sea.	32
Leaving the actual number added to the whole number of mechanics	19

And at Auburn, during the same period, one hundred and eight, namely:

Coopers	7
Tool makers	4
Shoemakers	10
Weavers	15
Tailors	4
Clock makers	2
Machinists	1
Smiths	3
Comb makers	4
Hame and saddle-tree makers	2
Cabinet and chair makers	7
Stone cutters	5
Spoolers	3
Tinman and brass founder	2
Carpenters	1
Laborers	13
Invalids	7
Females	6
Waiters, washers, and cooks	10
Barber and gardener	2
	108

* At work in other shops.

Among those who have been re-committed we select the following—hundreds of others might be added.

"Charles W. Zeiss—First time sentenced to city prison, 1826; second time, August, 1831, state prison; third time, January, 1834, acquitted and arraigned for false pretences.

"James Gallagher—Three times penitentiary; three times state prison.

"Peter Bowerhorn—Four times penitentiary; twice in state prison in New-York, besides having been in southern prisons; is 32 years of age, and been 17 years in prison.

"Patrick M'Gill—Three times in the state prison for grand larceny.

"William Tryon—Once state prison; twice penitentiary.

"William Simmons—Once state prison; twice penitentiary.

"Etyler Jacox—Three times state prison.

"Brickbat, alias Owen—Once penitentiary; once state prison.

"Henry Griffin—Three times state prison, twice for forgery.

"Josiah Hagar—Three times state prison; died there—an aggravated case."

Is such a state of things to be borne? Is it not time that a most decided stand should be made against this worst of all monopolies? Are we to remain passive spectators, while our children, our brothers, and our sisters, are liable to be made the dupes and assistants in crime, of such a set of *scoundrels?* No, no! We are persuaded that the mechanics, and the friends of mechanics, in America, will now rouse themselves; they will feel it a duty upon them to give the most determined opposition to such a system—to petition, to remonstrate; and never to cease their exertions until they obtain the abolition of a custom so obnoxious and so fraught with evil to the best interests of the community.

Mechanics—The Actions and Postures of Animals, and particularly of Man, illustrate beautifully the observations with respect to the centre of gravity.

A body, we have seen, is tottering in proportion as it has great altitude and narrow base—but it is the noble prerogative of man to be able to support his towering figure with great firmness, on a very narrow base, and under constant change of attitude. This faculty is acquired slowly because of the difficulty. A child does well who walks at the end of ten or twelve months; while the young of quadrupeds, which have a broad supporting base, are able to stand and even to move about almost immediately.

The supporting base of a man is the space occupied by and included between the feet. The advantage of turning out the toes is, that without taking much from the length of the base, it adds considerably to the breadth.

If there be much art in walking on two perfect feet, there is still more in walking on two slender legs, with rounded extremities; which, however, we often see done, by mutilated soldiers and sailors.

All the ladies of the empire of China have to acquire nearly the same talent as these victims of war; for barbarous custom has crippled them, by confining their feet for life in the shoes which fitted them in infancy.

But surpassing in difficulty any of these instances is the practice, which is general among the inhabitants of the sandy plains called the *Landes*, in the south-west of France, of walking on stilts. The *Landes* afford tolerable pasture for sheep; but during one portion of the year they are half covered with water, and during the remainder they are still very unfit walking-ground, by reason of their deep loose sand and thick furze. The natives meet the inconveniences of all seasons by doubling the length of their natural legs, through the addition to them of the stilts mentioned, which they call *des echasses*. Mounted on these, which are wooden poles, put on and off as regularly as the other parts of dress, they appear to strangers a new and extraordinary race of long-legged beings, marching readily over the loose sand, or through the water, with steps of eight or ten feet in length, and with speed equalling that of a trotting horse: their moderate journeys being of thirty or forty miles in a day. While watching their flocks, they fix themselves in convenient stations, by means of a long staff supporting them behind, and with their rough sheep-skin cloaks and caps, which cover them above, like thatched roofs, they appear like little watch-towers, or singular lofty tripods, scattered over the face of the country.

Still beyond the art of walking on stilts is that which some persons attain of walking and dancing on a single rope or wire; or even of keeping the centre of gravity above the base, while standing on the moveable support of a galloping horse. A rope-dancer usually carries a long pole in his hand, to balance him: it is loaded at each end, and when he inclines, he throws it a little towards the side required, that the reaction may restore his body to perpendicularity.

Much art of the same sort is shown in the attitudes and evolutions of the skater; in the amusements of supporting a stick upright

on the end of the finger; and in many other feats of a like kind.

Attitudes generally depend on the necessity of keeping the centre of gravity of the body over the base under variety of circumstances, as in—the straight or upright port of a man who carries a load on his head—the leaning forward of one who carries it on his back—the hanging backwards of one who bears it between his arms—the leaning to one side of him who is carrying a weight on the other side—the habitual carriage of very fat people, whose head and shoulders are thrown back, giving a certain air of self-satisfaction,—an air which belongs also to the state of pregnancy, and even to that of the dropsical patient, although producing in it so sad an incongruity.

When a man walks or runs, he inclines forward, that the centre of gravity may overhang the base; and he must then be constantly advancing his feet to prevent his falling. He makes his body incline just enough to produce the velocity which he desires.

A man, in pulling horizontally at a load, is merely causing his body to overhang its base, so that its tendency to fall may become a force or power applicable to the work.

When a man rises from a chair, he is seen first bending the body forward, so as to bring the centre of gravity over the feet or base, and then he lifts the body up. If he lift too soon, that is, before the body be sufficiently advanced, he falls back again.

A man standing with his heels close to a perpendicular wall, cannot, without himself falling forward, bend sufficiently to pick up any object that lies before him on the ground; because the wall prevents him from throwing part of his body backward, to counterbalance the head and arms, that must project forward. A man, little versed in such matters, agreed to give ten guineas for permission to try to possess himself of a purse of twenty, thus laid before him: he of course lost his money.

When a man walks at a moderate rate, his centre of gravity comes alternately over the right and over the left foot. This is the reason why the body advances in a waving line, and why persons walking arm in arm shake each other, unless they make the movements of their feet to correspond, as soldiers do in marching.

Sea sickness is a subject closely related to the present. Man requiring, as now explained, so strictly to maintain his perpendicularity, that is, to keep the centre of gravity always over the supporting part of his body, ascertains the required position in various ways, but chiefly by the observed perpendicularity, or other known position of things about him. Vertigo and sickness are the consequences of depriving him of his standards of comparison or of disturbing them.

Hence, on shipboard, where the lines of the masts, windows, furniture, &c. are constantly changing, sickness, vertigo, and other affections of the same class, are common to persons unaccustomed to ships. Many persons experience similar effects in carriages, and in swings; or on looking from a lofty precipice, where known objects being distant, and viewed under a new aspect, are not so readily recognized; also in walking on a wall or roof; in looking directly up to a roof, or to the stars in the zenith, because then all standards disappear; on entering a round room, where there are no perpendicular lines of light and shade, as when the walls and roof are covered with a paper which has no regular arrangement of spot; on turning round as in waltzing, or if placed on a wheel; because the eye is not then allowed to rest long enough on any standard, &c.

People when in the dark, and therefore blind people always, use standards belonging to the sense of touch; and it is because, on board of ships, the standards both of sight and of touch are lost, that the effect on persons is so very remarkable.

But sea sickness also partly depends on the irregular pressure of the bowels among themselves and against the containing parts, when the influence of their inertia and weight varies with the rising and falling of the ship.

From the nature of sea sickness, as discovered in these facts, it is seen why persons unaccustomed to the motion of a ship often find relief by keeping their eyes directed to the fixed shore, where it is visible; or by lying down on their backs and shutting their eyes; or by taking such a dose of exhilarating drink as shall diminish their sensibility to all objects of external sense.

As no condition or form of matter escapes from the great laws of nature, we find the attitudes and general condition of vegetable, as well as of animal bodies, characterized by the necessity of having the centre of gravity supported over the base. Thus, with what admiration do we contemplate the pine and other trees in the forests of nature, springing up to heaven as perpendicularly as if the plummet had been at work to direct them; and on the brows of precipitous hills no less than in the level plains! On a smaller scale, we see the grasses and corn-stalks of our cultivated fields illustrating the same truth. And whenever, in tree or shrub, accident or peculiar nature causes a deviation from the

laws of perpendicularity, additional strength and support are provided.—[Dr. Arnott.]

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from page 116.)

CHAPTER II.

ON THE ILLUSTRATIONS FROM MECHANICS.—The illustrations from Mechanics may be carried too far. Peculiar properties of life in the body. They differ in quality. They have an adjustment to each other more admirable than the mechanical connection.

We are the more desirous of entering upon this subject, that we may prevent the reader from founding a false conclusion upon the very mode in which we have hitherto proceeded, that of showing design in every part of the animal structure by taking our illustrations from the mechanism of the body.

When we have admired the connections of the several parts, or organs, thus made manifest by comparison with machinery, we may go too far, and say that the material structure and mechanical relation are to be found in still greater minuteness and perfection in the finer textures of the body—proceed to call this organization, and erroneously conclude that, out of organization, comes life. The very term organization misleads, yet it implies something constructed in which one part co-operates with another, but nothing more. Taking the body as a whole, there are undoubtedly instances of such co-operation, but it is in vain to seek the explanation of life from this, since life exists in simple and uniform substances, where there is neither construction nor relation.

Now, although there are mechanical construction and relation, as we have seen in bones, muscles, and tendons, the phenomena of the body result from a dependence established among the living properties, not the mechanical. The highest medical authorities have seen reason to conclude, that life is an endowment not resulting from organization or construction, but, on the contrary, producing it; in other words, that the living principle attracts the new matter, arranges it, and, in order to its continuance and perfection, alters it, and effects a continual revolution in it. For there is nothing more curious than the uninterrupted and rapid change of the material of the animal body, from the first pulse of life to the last breath that is drawn, of which we shall give abundant proofs before we close this inquiry.

In first approaching the subject we are blinded by familiar occurrences, and cannot comprehend all the links by which the visible phenomena of the living body are produced. Probably most of our readers believe motion to be a necessary consequence of life, and the very proof of its presence. The peasant stirs up an animal with his staff, and if it does not move he is satisfied that it is dead; and such is the experience of mankind. We do not reflect that many different qualities of the living powers must be exercised before sensibility is shown in its visible sign, the motion of the creature. It is not necessary that the parts shall lock into each other like the cogs of wheels; the connections established are of a different kind altogether. Each part possesses a property of life entirely distinct from the other, and this property of life may exist in the individual part (for a time at least) without that co-operation of the whole which is necessary for the motions of the animal.

This quality of life is, in one respect, like gravitation in matter; that is, when the mass is broken into parts, each division has its proportion of the endowment, and so the separated parts of a living creature possess life. But here the resemblance ceases: gravitation is the same quality in every part, and uniform in its effects, whilst the life is exhibited by qualities differing in every part of the animal body. Did these parts possess qualities exactly similar, they would remain at rest, and, though combined, they would not influence each other. It is the different powers brought into combination that produce the motion of the whole animal.

If a man fall into the water, and is dragged out motionless, and has ceased to breathe, each part of his body may still possess its property of life. Although the combinations have been destroyed, he may be revived by exciting action in some part of his system. Life still remains in his brain, and nerves, and heart, and arteries, and in the muscles, which should enable him to breathe; but the mutual influence, the bond of their united operations, is broken. We may take the analogy of a machine, and say that the wheels are stopped; but this is, in fact, a very different thing; it is the operation of the living influence that is stopped, for we repeat that nature, (by which, of course, is always to be understood the Author of Nature,) has combined the organs not mechanically, but by properties of life.

Artificial respiration draws after it the action of the heart, because the sensibility of the heart is made respondent to the lungs. Pulsation of the heart excited by the mo-

tion of the lungs, is followed by the action of the arteries; these organs, in operation, drive the blood through the frame, and, by the circulation, the susceptibility of each part to impression, which had been weakened, is restored. Action and re-action are re-established; but these actions are not like those of a machine, they are living properties; sensibility in one part, contractility in another; and after a variety of these internal sensibilities have been for some time in operation, the man gives outward token of recovery.

So a person recovering from fainting, after sobbing and irregular breathing, has the respiration renewed; in succession other parts recover their sensibility, and resume their places in the circle of relations; the skin is capable of being stimulated, and the limbs are capable of motion; the eyelids are opened; by and by the nerve of the eye is sensible to light, and the nerve of the ear to sound; and finally, the faculties of the mind are roused, and its control over the body re-established. The whole separate endowments of life in the different parts resume their offices; the last in the train; only the property of the muscle to contract is alone observed by the uninformed, and voluntary motion is the token of entire restoration.

We can imagine a half-learned person to act very foolishly in the attempt to restore the apparently drowned. He has been told that we draw in vital air, and breathe out what is unfit to support life; he imagines that it can be of no use to distend the lungs of the drowning person with his own breath, and precious time is lost. Whereas, the mere distension of the chest, that is, of the lungs, followed by the compression of the chest, and again by the distension, and so on alternately, is the *play of the lungs*, which by sympathy draws the heart into action, and in succession all the vital organs. This is not what chemistry teaches: chemistry shows us that the vital air influences the blood; and it is true that the blood, being refreshed or impregnated with the vital air, renews the properties of life. But this effect on the blood could never take place unless there were some previous consent or sympathy, putting the organs into operation. We repeat, that the consent of organs is not the effect of mechanical adaptation, or of chemical action, but of relation established among the vital properties.

If a man be struck by lightning, he has not merely the vital operation of respiration stopped, as in the case of the drowning man, in whom every organ continues to possess its property of life; he is not like a man struck on the head, where one vital organ is so disturbed that the circle of vital actions is broken; in this instance the electric fire passes through every fibre and every organ—all the qualities of life, whether residing in the brain, nerve, or muscle, are instantaneously destroyed, and the moment of death is the commencement of dissolution.

Mr. John Hunter illustrated this somewhat familiarly. If you bruise the head of an eel, its body writhes; but if it be taken by the tail, and struck on the flag-stone, so that every part of its body receives the shock, then all the parts are killed, and it remains motionless. When an animal is killed by that violence which injures one important organ, the property of life remains for a certain time in every part; those parts have no correspondence, and there is no outward token of life; but the vital principle is still capable of exhibiting one of its most important properties—it arrests the operation of those chemical affinities which belong to dead matter.

Thus the reader perceives, that, although he be led on to comprehend the design or intention manifested in the structure of the body by mechanical instances or comparisons, it is when we contemplate the influence of the living principle, that we have a higher conviction of the Omnipotence, which has formed every creature, and every part of each creature, with that appropriate endowment of life which suits it to act its part in the general system.

We must learn to distinguish between the death of the animal, and the death of the parts of the animal—between apparent death and dissolution, or the separation of that quality which distinguishes living matter.

Viewing the subject generally, as Mr. Hunter said, there are not two kinds of matter, but two conditions of matter. It is at one moment forming beautiful combinations, as in the flower, through the principle of life, and, at another, it is cast away as noxious, undergoing changes by decomposition, from chemical processes solely. The want of combination in the whole animal body exhibits apparent death. The loss of life in all the parts of an animal body is absolutely death, and the material becomes subjected to the influence of the chemical affinities, instead of being urged into motion by life.

The jackstone produces motion in one part of a machine; that, varied by mechanical influence, is communicated to a second; from the teeth of one wheel it is communicated to the corresponding leaves of the pinions, and from the pinions to the fusees. But what a base notion it is to suppose that

the mere property of weight in the jackstone is like the influence of life!

The weight is the power, in the language of mechanicians; but it does not reside in the parts of a machine, nor does it exhibit different qualifications in these parts. Separate them, and they are nothing. On the contrary, no one part of an animal body is in this matter dependent on another for its property of life. The property is inherent in the part itself, and the wonderful thing is that each property in the several organs corresponds with the others so as to form a circle of vital operations. There is no transmission of power, in all this, from part to part—no train of connection to be traced as from the jackstone, or the spring, along the parts of the machine. There is therefore, in truth, no resemblance between machinery and the influences in operation in a living body. What is to be admired in a living body is not merely the adaptation of bones, muscles, and tendons, forming a mechanical apparatus, but rather the different qualities which life bestows upon different parts; these qualities put the parts into relation, each according to its place in the circle of the economy; and among innumerable properties of life in the individual parts, produce that perfect co-operation as if one principle only actuated the whole.

When a person moves under the direction of the will, nothing can be more simple to our understanding, because we do not attempt to trace the links, far less to estimate the powers in the several parts influenced during this familiar action. But if there be the slightest diminution of sensibility of one nerve, so that it shall not transmit sensation, or if there be any disturbance which retards in the least degree the transmission of the will along another appropriate nerve—if the muscle be benumbed, or have lost its irritability—if the action of the blood vessels has been either diminished or increased beyond their ordinary course, either in the organs of sense, the brain, or nerves,—we are appalled by the consequences. The impressions of things are not felt; the senses are unexercised; the limbs remain inactive; one half, or the whole, of the body is a load, as if there were a living being in a dead body—a body whose parts refuse their office—appearing dead, though they are not so. The correspondence of their living qualities has alone been disturbed; the movement which results from the whole is stopped, and there is apparent death.

What confusion then must be engendered in the minds of those who would confound the phenomena of life, as presented in the entire frame-work of the body, with those separate qualities of life, which, residing in the several parts, must enter into combination for the motion of the whole!

The next step of this unphilosophical manner of treating the subject is to make the organization the source of the living property,—as if any combination of organs could produce life,—as if those organs could have motion without the distinct endowments of life in their separate parts,—as if they co-operated mechanically, and not from the correspondence among their living properties. Those who thus reason mean to say, that parts are made so finely as to move of themselves, one part propelling another, and the motion of the whole producing life. It is quite clear, that this confusion of ideas arises from contemplating the phenomena of the perfect animal, in which all intermediate influences are confounded. On the other hand we present this proposition.

The several *simple* substances of a living body have each an endowment of life bestowed upon them. Let us take the obvious qualities, of sensibility—the power of transmission—and the power of motion; each of which is appropriate to a particular substance. When these qualities are put in relation, impressions may produce motion, and thus there are three distinct properties of life brought into operation. Where is the organization or construction here? Without those living endowments, these parts would be inoperative, in whatever juxta-position placed. The mechanical construction of the body is one thing,—and we are able to admire it, because it can be illustrated by comparison with our own contrivances; the combination of living properties is another and an entirely different thing.

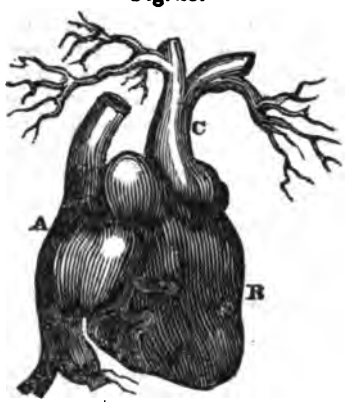
We here reach the limit of philosophical inquiry. Hitherto all has been flattering to the pride of the creature, but we must now humbly acknowledge the inscrutable ways of the Creator; and ceasing to trace the origin of life more than we do that of gravitation, we should be occupied in observing its laws, not in exploring its source.

We shall take an instance to illustrate the difference betwixt the mechanical connection of parts and their relations through the living properties; and it will, at the same time, show how curiously the living properties and the mechanical properties are made to correspond with each other.

A stream of water is converted into a mechanical power: it fills a cistern, which is attached to a lever; the cistern descends by the weight of water; by its descent a valve is pushed open; the water escapes, and the

cistern ascends, and remains so till the stream flowing into it again depresses it. Thus the regularity of the supply of water gives regularity of motion to the machine. Compare this with the heart.

Fig. 23.



We may describe the heart as consisting of two cavities, the one called the *Auricle*, and the other the *Ventricle*. The sinus A, (fig. 23,) receives the blood returning by the veins; and gradually filling, like a cistern, it becomes so distended that its muscular power is excited; it contracts, and delivers the blood with a sudden impetus into the second cavity, or the ventricle B, which, in its turn, excited by the distension, contracts, and propels the blood into the artery C. Here the action of the heart is accounted for, by its mechanical distension with the blood; and the regularity of its motions necessarily correspond with the regularity of the supply. The distension produces action, and the propulsion of the blood from the cavity allows a momentary state of rest, until another volume of the blood excites another pulse.

But we have now to observe, that when this irritability or muscular power was bestowed upon the heart, it was directed by a law entirely different from the irritability as possessed by other muscles. A property of alternate activity and rest was given to it, quite unlike the contractility of other parts; and accordingly, when the heart is empty, when there is no distension of blood at all, the two cavities will continue their alternate action. Nay, if the heart be taken from the animal recently dead, it will continue to act in regular successive pulses, first the one cavity, and then the other, and so on successively for a long time, until the life be quite exhausted. The two cavities will thus continue in alternate action, as if they were employed in the office of propelling the blood, when there is no blood contained within them. It is superfluous to observe that no such thing could happen in the case of the cistern and lever, were the stream of water to cease running.

Thus we distinguish two things quite different: a mechanical or hydraulic provision, by which these little cisterns, the auricle and ventricle, shall be regularly supplied, and alternately filled and emptied—and the property of contraction in the heart, not a mere property of contraction from irritation, as in the other muscles, but a property far more admirable, since the irritability or power of contraction of the part is ordered with a reference to its office—that it shall contract and relax in regular and rapid succession, and continue its office unweariedly through a long life. The living property of the heart exhibits a variety adapted to its office, and a correspondence still more admirable than the mechanical relation. We are thus particular in distinguishing the mechanical adaptation of parts from the co-operation of the vital influences residing in the several parts; for there are many who will take the illustration from mechanics, and stop their inquiry there, and who entertain a confused notion of the dependence of the life of the body on its mechanism.

Another mistake which some philosophical inquirers entertain, is to fancy that the principle of life is of a galvanic nature. There is, indeed, an unwillingness in men to acknowledge that their powers of reason are exhausted, and that they have arrived at an ultimate stage; they would fain set up some contrivance to hide the humiliating truth. Whatever notions have prevailed in the schools at different epochs, of heat, electricity, or galvanism, we find an attempt to explain the phenomena of life by an application of the powers with which they have been successful in their physical inquiries. Experiments without reason are equally delusive with hypotheses; those who will not give themselves the labor of thought, desire to witness striking phenomena; wonder-struck, they believe that they are engaged in experimental investigation, when their state of mind is little better than idle amazement. A calf's head is made to yawn, or a man cut down from the gallows to move, like a figure of cards pulled with strings; the jaws move, and the eyes roll, and this is done by conveying the galvanic shock to the nerves; here it is supposed that nothing less than the principle of life itself can work such wonders, and that galvanism is this principle.

Putting aside the circumstance already

stated, of life exhibiting totally different phenomena in union with different parts, is there any point of resemblance between galvanism and life? Does tying the nerve stop the influence of galvanism as it does the influence of life? Does galvanism course along a cord when it is surrounded by matter in contact with it of the same nature? can life pass out of one body into another, like heat, or electricity, or galvanism? Can *they* be contained by a thin membrane? Does life pass equally through all the parts of a moist animal body as one uniform influence, like galvanism?

In no circumstance is there a resemblance, and the whole phenomena resulting from galvanism transmitted through an animal apparently dead, are fairly to be attributed to its being a high stimulus conveyed through the moist animal body, and exciting the powers which remain insulated in the several parts; and in exciting those forces, far from renewing them, it exhausts them altogether.

The uses made of galvanism, in the explanation of the living phenomena, should make sensible men very cautious how they carry the legitimate inductions of chemical science into another department. They will not submit to call the irritability or contractility of a muscle an endowment of life, but seek to explain it by organization. They employ the microscope; they find the ultimate fibre to be some thousandth part of an inch in breadth; they see plicæ or folds; they imagine them to be cells into which the fibres are divided; they furnish these cells with two different gases, and explode them by some galvanic influence of the nerves; and the explosion, by dilating the cells in one direction, causes the contraction in another. This is the theory of muscular action at the period of the discovery of the gases; and some such idle hypothesis, supposed applicable to the laws of life, accompanies every considerable improvement in chemistry.

In the most modern and the most popular French work on Physiology, by M. Richerand, he says, "What appears to me by much the most ingenious opinion, and which carries with it the greatest probability, is that which supposes the contraction of the muscle to depend on the combination of hydrogen, carbon, and azote, and other combustible substances which exist in the fleshy fibre, with the oxygen conveyed to them through the arteries." But he adds, 'as if he had perfected the theory,' "it is also necessary to suppose, that a nervous fluid is directed through the muscle to determine the decomposition, as the electric spark forms water out of two gases."

Such is the chemical theory of muscular motion; it betrays an entire misunderstanding of the phenomena of muscular motion, and of the beautiful provision in every muscle for its appropriate office. The muscles, which are subservient to the organs of sense, differ in their operations altogether from the voluntary muscles of the limbs. The hollow muscles, as they are termed, those which carry down the food, and which carry round the blood in circulation, vary in their time and manner of acting according to their offices; but what conception can he have of such adjustment of powers, who is entertaining himself with a theory that supposes a sudden explosion to take place in the fibres of the muscle at their time of action? Inductive reasoning, which has carried men to the highest acquirements in physical science, is here laid aside; conjectures totally inconsistent with the phenomena of life are employed in its stead, and the useful philosopher becomes a very indifferent physiologist.

The Art of Wine Making—the Gervais Fermenting Apparatus Improved.

[From the London Mechanics' Magazine.]

Mr. Booth, whose treatise on the Art of Brewing we lately noticed,* has just produced another treatise on the kindred "Art of Wine-making;"† or, to speak more properly, a volume supplementary to the former. The general principles, and many of the manipulations, of the two arts are so similar, that the business of this new treatise consists mainly in pointing out those peculiarities by which the manufacture of wine differs from that of beer; and the two treatises are so intimately connected, that the one cannnot be profitably perused without constant reference to the other. As Mr. Booth himself observes, "the four parts of the Art of Brewing and these two of Wine-making, with the Appendix on Cider and Perry, may be considered as one continued work, embracing a general system for the manufacture of vinous liquors."

Mr. Booth in his present work treats first of "Wine-making in Warm Countries," and next of "Wine-making in Cold Countries;" or in other words, of foreign and home-made wines in all their numerous varieties. He gives, under both these heads, a great deal of very useful (though not often very novel) information, derived from the most authentic

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* See p. 1, vol. iv., of this Magazine.

† The Art of Wine-making in all its branches. By David Booth. To which is added an Appendix concerning Cider and Perry. London: F. J. Mason. 123 pp. 8vo.

sources, and interspersed with much shrewd observation and judicious advice. One of his best chapters relates to the much contested point, whether open or close tuns are best suited to the process of fermentation? The ancient practice of the wine provinces of France was to leave the tuns open, or, at least, to cover them very slightly; but at the beginning of the present century, a Mademoiselle Gervais introduced a close fermenting apparatus, (afterwards patented in Great Britain by Messrs. Deurbrouck and Nichols,) which having the good luck to be patronised by the celebrated Chaptal, has become all the fashion among our French neighbors. According to the partisans of this new method, it serves not only "to condense, and to return into the fermenting fluid, all the aqueous, spirituous, and balsamic vapors which are usually carried off with the carbonic acid gas, and thereby to enrich the wine, by preserving entire its spirit and perfume," but actually augments the quantity of wine obtained, by from 9 to 15 per cent. Mr. Booth does not altogether dispute these conclusions, but he insists that they are prodigiously exaggerated. He maintains that the increase of volume is "not above one in two hundred;" that "this increase is caused by the condensation of all the gas that is evolved during the whole progress of the fermentation;" and that the proportion of this condensation, which is spirituous, is probably "very small."

We shall leave Mr. Booth, however, to speak for himself. He commences very properly by describing what the Gervais apparatus is, and how it has been proposed by M. Dubrunfaut to free it of its more striking defects.

"Z Z, A A, (see fig. 1,) is the perpendicular and central section of a fermenting-tun, with the apparatus affixed to the close head Z Z.

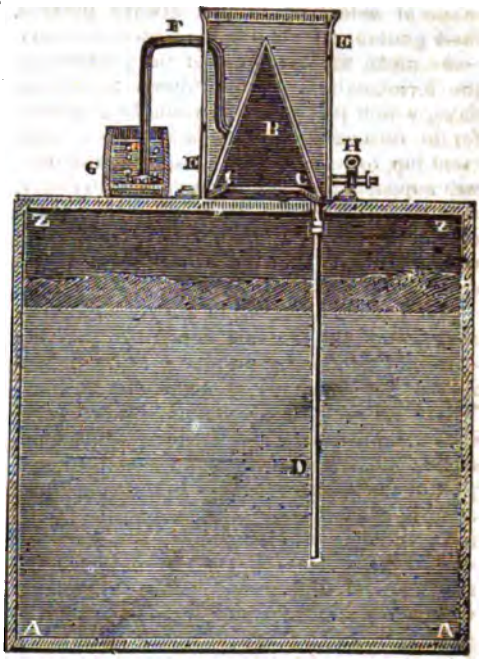
"B is a cone of tinned iron plate, communicating at bottom with the tun, by means of a hole in the cover Z Z.

"C C is a small channel extending round the interior base of the cone, being adapted to receive the condensed '*alcohol* and *essential oils*;' from whence they are conducted, down the small pipe D, into the lower part of the liquor in the vat.

"E E is a cylinder of the same material as the cone which it surrounds, and containing cold water, for the purpose of condensing the vapors which rise into the cone during the fermentation.

"F is an egress pipe, communicating with the interior of the cone. its extremity being immersed to the depth of six inches, at least,

Fig. 1.



below the surface of the water in the small tub G, from whence the incondensable gases are permitted to escape into the atmosphere.

"H is a cock to draw off the water from the reservoir E E, when it becomes warm, and requires to be replaced with cold water, as is the case in high fermentations.

"It is asserted by the French chemists, and conceded by Messrs. Deurbrouck and Nichols, the English patentees, that the vinous fermentation will not commence without the access of atmospheric air or of oxygen; but after it has once begun, the further exposure to the air is unnecessary; and the quantity contained in the empty space (left in the tun to prevent the head from rising into the cone) is, they say, perfectly sufficient to originate the fermentation: but, they add, 'as soon as carbonic acid is evolved from the fermenting gyle, the atmospheric air, being lighter, is driven out from the upper part of the working tun; and as no air is permitted to enter afterwards, all the subsequent carbonic acid gas emitted diminishes the quantity of oxygen contained in the gyle, by the oxygen uniting with the carbon as fast as it disunites from the saccharine matter during its decomposition, and thereby secures a soundness and peculiar mildness not to be produced by any other mode.'

"Never having seen the effects of fermentation in tuns, thus, as it were, hermetically sealed. we cannot personally join in their

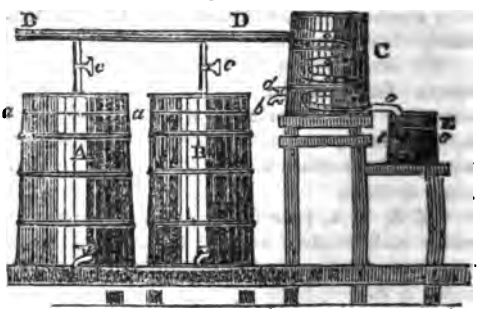
praise; but we apprehend that there is one inherent defect which will always prevent their general adoption in the British brewery —we mean the tardiness of the progress of the fermentation. From fifteen to twenty days, which it is granted would be requisite for the fermentation of table beer, is a sufficient bar to its adoption. On this principle, we suppose that the Scotch ale brewers, who, even with open tuns, often take three or four weeks to a gyle, would require the whole of their brewing season for a single operation.

"It will be observed in the preceding description of the Gervais apparatus, that the extremity of the *egress pipe* F is immersed in water *to the depth of six inches at least.* These six inches impose an additional pressure upon the surface of the fermenting fluid, equivalent, at an average, to the sixty-fourth part of the whole weight of the atmosphere; and, in consequence, has a material effect in preventing the escape of the carbonic acid, thereby retarding the attenuation. 'In fact,' says M. Dubrunfaut, 'the gas, meeting with a powerful obstacle, which opposes its passage through this condensing apparatus, forces its way by other issues, which it finds in the pores of the wood, and the fissures of the lutes which are recommended to close the joints of the cover of the tun. The portion of the gas which thus escapes, by openings that can never be kept closed under such a pressure, subtracts the alcoholic vapors from the refrigerator, and is a fundamental error in the construction of the Gervais apparatus.' We may add, that had it even been perfect, it was not new: it was nothing more than a combination of two principles which had been long known—the condenser of Jean Baptiste Porto, a Neapolitan, which was described in a work on Distillation, published by him in 1609; and the hydraulic valve of M. D. Casbois, which was announced in a French Journal of Sciences and the Arts in 1783.

"It will naturally be asked, in this place, whether or not the rise in the barometer, to the extent of about half an inch, would not have the same effect on the vinous fermentation as the Gervais apparatus? We say that it would have more: for, in the case of an increased weight of the atmosphere, the pressure all around the tun would be equal to that upon the surface of the liquid. One marked difference would be, that there would be no exit through the pores or chinks of the tun; for these fissures would be equally pressed upon by the external atmosphere. We have been long aware that the variations of the barometer are indicative of alterations in fermentative processes of every kind; and we doubt not that a time will arrive when that instrument will be considered as a necessary appendage to the other instruments which are now consulted by the manufacturers of vinous liquors. Persons who have not attended to this particular subject, (and there are few who have,) can have no conception of the effects of atmospherical variations. Wine-making is confined to a certain season, and to countries where the variation of the barometer is comparatively small; it is in the regions of the north that those effects are more particularly worthy of observation. On this subject we have made many experiments; but what might be useful as suggestions to a scientific manufacturer, would be here out of place. As long as the mind remains doubtful of the facts, they ought not to be given to the world as *knowledge.*

"The author last quoted has proposed a mode of close fermentation, which is free from the errors and absurdities that attach to that of Mademoiselle Gervais; and as it may be useful in the vinous fermentations of this country, and does not interfere with the English patent above mentioned, we take this opportunity of publishing a brief description of the process:

Fig. 2.



"A and B, in fig. 2, represent two of any number of fermenting tuns, which may be arranged and combined on the same principle. They are here re-printed as of the same size, and as placed on the same horizontal level; but these circumstances, though convenient, are not necessary. The lines *a a* and *b b* mark the surface of the *must*, or other fermentable liquid.

"D D is a pipe, communicating with each tun by means of branches, which are inserted through the close head, and which may be stopped at any time, by means of the stop-cocks *c c*.

"C is a cask or other vessel, filled with cold water, through which the pipe D D is

continued in the form of a worm, *o o o o o*: this water may be drawn off when too warm by means of the cock *d*, when this refrigerator can be re-filled with cold water, through an opening in the head.

"E is a smaller vessel or tub, destined to receive the product of the condensation of the vapors arising from any or all of the fermenting tuns. Those vapors rising in the branch pipes *c c*, into the main D D, pass through the worm *o o o o o*, which is bent, when it leaves the refrigerator, into the tub E reaching half-way to its bottom.

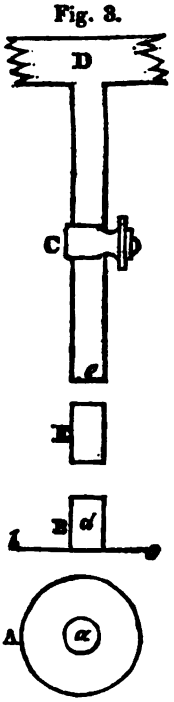
"It will be obvious, from this arrangement, that the condensable vapors which arise with the carbonic acid gas, will, by passing through the refrigerator, be collected at the bottom of the tub E in a fluid form, while the upper part of the tub will be filled with gas. Care must be taken to draw off portions of this fluid from time to time, (by means of a cock in the bottom of the tub, which is not here represented,) so that it may never rise above the level of the orifice of the worm; for were the fluid, for example, to rise to the level *e e*, it would, according to its gravity, form an hydraulic valve, which would cause an additional pressure upon the surface of the fermenting liquid, the prominent objection to the Gervais apparatus.

"On this plan, the complex apparatus for each tun is rendered unnecessary; for a single one of sufficient size will serve for any number of working tuns. The condensed liquid is not hereby returned to cool the fermenting mass; and the distiller, for whom we should suppose the practice well adapted, might carry the liquid from the tub E directly to the still. It may, however, be returned into the mass by a long-stalked funnel, if desired. The worm gives a free passage to the vapors; since its lower extremity, being plunged only in carbonic acid gas, cannot be said to offer any obstruction. The liquid in the tun is then fermented solely under the simple pressure of the atmosphere; and the carbonic acid gas, finding an easy escape through the opening of the worm, no longer seeks to force a passage through the pores of the wood or the chinks of the tun.

"The gas, which, on account of its density, constantly fills the tub E, prevents all risk of absorption of atmospheric air as completely as is done by the hydrostatic valve of Gervais. When there is a range of tuns, one or more will be continually discharging carbonic acid gas; but where there is only a single tun, and that not in full operation, the accession of air could be equally well prevented, for it would only be necessary to fill the tub with water until the surface should rise two or three-tenths of an inch above the lower extremity of the worm, as shown by the line *e e*.

"When we want at any time to look at the state of a tun, we have only to shut the cock *c* (which shuts out all communication with the others), and, opening a plug-hole in the head, draw off what we require by means of the cock at the bottom. In the same manner we may charge and discharge the several tuns successively, without their interfering with one another. Each may be washed out by having a *man-hole* in the upper end; or it may even be taken away and re-placed by another, without retarding the operations of its neighbors. For the more easy performance of this latter purpose, M. Dubrunfaut recommends the following disposition of certain parts in the construction of the apparatus:

Fig. 3.



"Fig. 3 represents, on a larger scale than that of fig. 2, the pieces necessary for the purpose above mentioned.

"B is a tube and flange, seen sideways, of which A is the face, being a circular plate of the diameter of its section *b c*. This piece is fixed by nailing the disc *b c* upon the head of the tun, in such a manner that the opening *a* corresponds with the hole which is made in the head of the tun, for the purpose of allowing the escape of the gas: the

tube *d*, of which *a* is an extremity, being of the same diameter as the hole.

"The tube *d*, which is thus perpendicular to the head of the tun, is of the same diameter as the tube *e* of the piece C; and these two tubes, when the apparatus is finished, will be united at their orifices so as to form a single continued pipe. In order to close completely any little openings between their orifices, the cylinder E, the diameter of which is a little larger than that of the tubes *d* and *e*, is drawn over the junction, and its extremities are luted to those tubes so as to prevent all access of air or escape of gas. The piece C is previously united to the larger tube D, which here represents a part of D D, fig. 2. From this disposition of the parts, it is easy to see, that by shutting the cock of the piece C, and pushing upwards the moveable socket E, the tun may be completely disengaged, without affecting any other part of the general arrangement.

"We have dwelt the longer on this subject because of its probable adoption by the distiller and vinegar maker, for whom we should suppose the close fermentation to be better adapted than to the brewer, or even to the foreign wine-maker. The produce will be found to be very various, according to the heat of the fermentation and the quality of the fermenting fluid. At an average, perhaps, it may be estimated at about the two-hundredth part of the quantity of liquid that is fermented; and in quality, chiefly water mixed with a small portion of alcohol, or rather of the immediate materials of alcohol."—pp. 16–23.

On the adulteration of foreign wines, we have the following acute remarks:

"To the inhabitants of this country it is of much less importance to know how any particular species of foreign wine is manufactured, than to learn how to guard themselves from the effects of its adulteration. The following observations may, perhaps, account for an occasional accident, and at the same time may serve as a caution to the bottlers of wine in this country.

"We have already mentioned, that the bottled wines of the Continent (particularly champagne) undergo at least one or two *decantings* or *rackings* in the bottles before they are exported. A *bin* of wine is tried, to see whether or not it is fit for the foreign market. The practice is (especially in the wine of which we speak) to use very fine, that is, elastic corks; to push them half into the bottle; and to press the upper part over the neck, in a sort of girth or rim, which is kept down by means of twisted wire. This cover of the top of the bottle is re-covered with wax of a certain color, and what that color is depends on the substances with which the wax is mixed. If it be yellow, the coloring matter is orpiment; if it be green, the color is usually given by a mixture of orpiment and Prussian blue. Both these coloring matters are poisonous; for orpiment is sulphuret of arsenic, and Prussian blue is formed from one of the most instantaneous poisons —the prussic, or, as it is now termed, hydrocyanic acid.

"Let us suppose, then, that a bin of champagne is intended to be exported, or, if in a British cellar, to be sent to a customer. A bottle is drawn for trial, and is found to be deficient in effervescence. This can be remedied by inducing a new fermentation; and we know that it is the practice to accelerate this desirable quality by means of the introduction of a syrup of sugar candy, mixed and purified with cream of tartar. This addition, which is put into the bottle in proportion to the taste of the customer, is certainly not deleterious. But the cork is drawn, the seal is broken, and a part, perhaps a few chips of the wax, is rubbed off, and enters into the bottle. If the color has been either green or yellow, arsenic also enters; and, unfortunately, the world is but too well acquainted with the consequences. We may also add, that in French cellars the wax has another object in view besides (what is generally thought) the exclusion of the atmospheric air. In that country there are numerous swarms of insects, who are ready to devour the corks, and penetrate to the liquid. As far as regards these insects, the poisonous quality of the coloring matter is not to be regretted."—p. 52.

A danger of a less formidable nature to be guarded against, is the substitution of certain home-made imitations for the genuine products of the continental vineyards:

"Of all the vinous liquids which are manufactured in this country, beer and ale, cider and perry, (and mead and mum, when not banished by excise regulations,) are the only kinds that can be called national. The juices of most of our native fruits possess too little *saccharum* to be fermented pure; and when malt wort, or honey, was formerly added, as sugar has been in late times, the compound was also flavored and colored with extraneous substances, so as to imitate one or other of the favorite wines of the Continent. This was more particularly attended to when the making of 'sweets,' or 'British wines,' became a trade. The imitation of foreign wines originated in fraud, and excise duties raised the imitators to the rank of authorised manufacturers. As long as these gentlemen

were contented with the ordinary names of currant wine, gooseberry wine, &c. all was well; but we now see champagne, sherry, port, &c. in the bills of the British wine makers, and we have little doubt that some of these compounds occasionally find their way into the cellars of the 'dealers in foreign wines.' Champagne, in particular, is a very high priced article; and the British champagne, made from gooseberries, if properly made, and drunk when young, may impose upon three-fourths of the purchasers. Perry, also, particularly in mixture, is passed off for champagne, and is, perhaps, not much inferior to the real wine which it imitates. It is not so much the inferiority as *the lie*, which passes a cheaply made article for one that is more expensive, that constitutes the quackery and the crime of those ingenious imitators. If we can make a British wine equal to champagne, we have a right to do so; but we have no right to pass it off *in trade* as a foreign wine."—pp. 61, 62.

In the "Appendix concerning Cider and Perry," Mr. Booth represents the English manufacture of both these liquids to be in a very declining state. His observations on the subject are well deserving of attention:

"We have reason to believe that the superior sorts of perry, as well as of cider, though they may have the same names, are not equal to what were sold for such forty or fifty years ago. Most of the trees that were famed for the excellence of their produce are either dying or dead. Mr. Marshall published his Rural Economy of Gloucestershire in 1789, at which period he laments the decay of the finest fruit trees. 'All the old fruits,' he says, 'which raised the fame of the liquors of this county (Herefordshire,) are now lost, or so far on the decline as to be deemed irrecoverable. The *red streak* is given up; the celebrated *stire apple* is going off; and the *squash pear*, which has probably furnished this country with more *champagne* than was ever imported into it, can no longer be got to flourish; the stocks canker and are unproductive.' The squash pear is described as remarkable for the tenderness of its flesh, which bursts, (or rather burst*ed*,) if allowed to fall ripe from the tree; and hence the name.'—pp. 119, 120.

The pity is the greater, that our British perry is (or rather was) a species of wine particularly worthy of cultivation:

"Perry, when the manufacture has been successful, is much more similar than cider to the sweet wines of the grape. Without any mixture it has often been taken for the best quality of effervescing champagne. The juice, mixed with an equal quantity of a purified syrup of sugar or of honey, of about 25 lbs. gravity, (being allowed to finish its fermentation, so as to be bright before bottling,) is scarcely to be distinguished from a foreign wine of a superior species."—p. 121.

On the Construction of Railroads.

To the Editor of the Railroad Journal:

Sir,—You know it is only a matter of course that I should read the article of "J." on the subject of a road of earth expressly for steam carriages, in your 32d number, with peculiar gratification. (See Mechanics' Magazine, vol. iv., p. 109.) It is by no means certain that the subject will attract the attention of those who are most interested, and able to turn the suggestions to a good practical account. I hope it may. However, I offer you a few further observations in relation to it of a plain character. Experience must show what kind of road is best for this purpose. I observe, that at this time, (the season is dry,) the heavy stage, with its small wheels of narrow tire, and when full of passengers and baggage, (near 3 tons,) in passing by my door, if the wheels happen to go a little out of the common track, which has been beaten into dust by the horses' shoes and the wheels, they make a track or indentation that is scarcely perceptible.

The materials of this road are not gravel, but a mixture of sand and clay, such as constitutes either the upper or the second stratum of earth generally through this region. It is perfectly apparent then, that, when dry, if it were accurately graduated, and not cut up by horses' feet and narrow tires, it would be little inferior to a rail. During the time a drizzling rain is falling, it certainly is softened one eighth or one fourth of an inch, but immediately after the rain it dries and recovers its solidity, and this result would be accelerated and perfected by the passing of such wheels as "J." has suggested. From the showing of this writer and various articles which have appeared in the Journal, it is manifest that the advantage which a railroad has over a road of earth is limited to a road level, or nearly so; and that when you arrive at an ascent of one in fifty, it is even better than a railroad. Can this be so? Few railroads can be constructed without occasional ascents as great as one in fifty. But, evidently, if a line of road have *one* such inclination, this, of course, limits the performance of the locomotive, for, practically, it is of no use to give it a greater load on the level portion than it can take over the ascent; and all the

advantage which a railroad has over a road of earth, practically, is lost. Nay, if it should have one ascent near to that which requires additional aid, it is greatly superior, and that superiority increases rapidly as the inclination is greater. I say again, can it be so? What is, then, the necessity of railroads?

But, furthermore, the construction of a railroad is a nice affair; every part must be kept perfectly tight and in its place; only small wheels can be used; and, although for trial and exhibition a locomotive may run even 40 or 50 miles an hour, yet, practically, they do not exceed 15 or 20. Whereas, it appears to me, that by the use of large wheels, (and why may they not be made even 15 feet diameter,) a locomotive may be driven on a road of earth, ordinarily, at any velocity which the resistance of the atmosphere will admit—say 50 to 60 miles an hour. It is certain, at least, that the progress of the large wheel is not only greater for each revolution, but its motion is much more smooth and equable, and not subject to jostling or agitation. I am not at present aware of any disadvantage attending large wheels, except their gravity causing a greater indentation of the road, and greater resistance in ascending an inclination. The first, I think, would be prevented by the increased diameter and breadth of tire, and the latter compensated by the greater adhesion; and finally, engines of almost any required power could be used.

Perhaps most of the above remarks are merely repetitions of what you have published before; but if there is not some very great fallacy or mistake in all that has appeared on this subject, they ought to be repeated until noticed and tested by experiment.

But, one word more: if roads of this description, by reason of frost, are not adapted to northern regions, they certainly are to Virginia, Kentucky, and all the southern part of our favored land, where little inconvenience is occasioned by frost. C. O.

WHAT O'CLOCK IS IT?—When I was a young lad, my father called me to him that he might teach me how to know what o'clock it was. He told me the use of the minute finger and the hour hand, and described to me the figures on the dial plate, until I was pretty perfect in my part.

No sooner was I quite master of this additional knowledge, than I set off scampering to join my companions at a game of marbles; but my father called me back again, "Stop, Humphrey," said he, "I have something more to tell you."

Back again I went, wondering what else I had got to learn, for I thought I knew all about the clock quite as well as my father did.

"Humphrey," said he, "I have taught you to know the time of the day, I must now teach you how to find out the time of your life."

All this was strange to me, so I waited rather impatiently to hear how my father would explain it, for I wanted sadly to go to my marbles.

"The Bible," said he, "describes the years of man to be three-score and ten, or four-score years. Now, life is very uncertain, and you may not live a day longer; but if we divide the four-score years of an old man's life into twelve parts, like the dial of a clock, it will allow almost seven years for every figure. When a boy is seven years old, then it is one o'clock of his life, and this is the case with you: when you arrive at the age of fourteen years, it will be two o'clock with you; and when at twenty-one years, it will be three o'clock. Should it please God thus to spare your life, looking at the clock may perhaps remind you of it. My great grandfather, according to his calculation, died at twelve o'clock; my grandfather at eleven; and my father at ten. At what hour you and I shall die, Humphrey, is only known to Him to whom all things are known."

Never since then have I heard the inquiry, "What o'clock is it?" nor do I think that I have even looked at the face of a clock, without being reminded of the words of my father.

I know not, friends, what o'clock it is with you, but I know very well what time it is with myself; and that if I mean to do any thing in this world, which hitherto I have neglected, it is high time to set about it. The words of my father have given a solemnity to the dial plate of a clock, which it never would, perhaps, have possessed in my estimation, if these words had not been spoken. Look about you, my friends, I earnestly entreat you, now, and then ask yourself what o'clock it is with you.

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MECHANICS' MAGAZINE,

AND

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VOLUME IV.] FOR THE WEEK ENDING SEPTEMBER 20, 1834. [NUMBER 3.

"A taste for knowledge, a capacity to acquire it, and a pleasure accompanying its acquisition, form the constitution of every mind."—DR. DICK.

History of Astronomy—its various Systems, &c. [Continued from page 101.]

OF THE STRATUS.—This modification has a mean degree of density.

It is the lowest of clouds, since its inferior surface commonly rests on the earth or water, as represented by the figure above annexed.

Contrary to the last, which may be considered as belonging to the day, this is properly the cloud of night, the time of its first appearance being about sun-set. It comprehends all those creeping mists which in calm evenings ascend in spreading sheets (like an inundation of water) from the bottom of valleys, and the surfaces of lakes, rivers, &c. &c. Its duration is frequently through the night.

On the return of the sun, the level surface of this cloud begins to put on the appearance of cumulus, the whole at the same time separating from the ground. The continuity is next destroyed, and the cloud ascends and evaporates, or passes off with the appearance of the nascent cumulus.

This has been long experienced as a prognostic of fair weather, and indeed there is none more serene than that which is ushered in by it. The relation of the stratus to the state of the atmosphere, as indicated by the barometer, &c. appears notwithstanding to have passed hitherto without much attention.

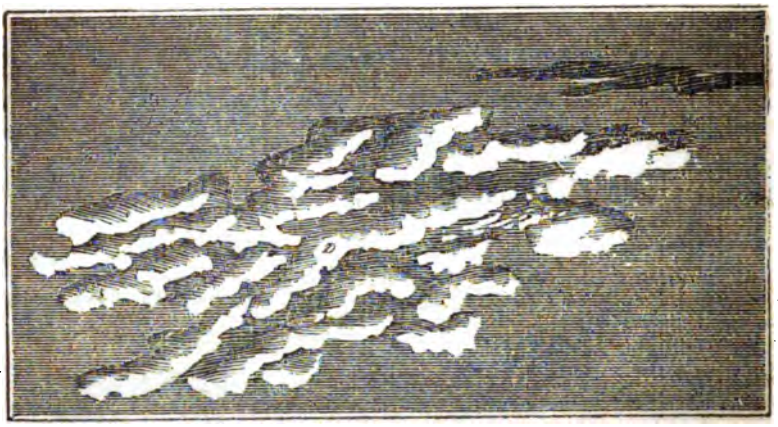
OF THE CIRRO-CUMULUS.—The cirrus having continued for some time increasing or stationary, usually passes either to the cirro-cumulus or the cirro-stratus, at the same time descending to a lower station in the atmosphere.

The cirro-cumulus is formed from a cirrus, or from a number of small separate cirri, by the fibres collapsing as it were, and passing into small roundish masses, in which the texture of the cirrus is no longer discernible, although they still retain somewhat of the same relative arrangement, as exhibited by the following figure. (See next page.)

This change takes place either throughout the whole mass at once, or progressively from one extremity to the other. In either case the same effect is produced on a number of adjacent cirri at the same time, and in the same order. It appears in some instances to be accelerated by the approach of other clouds.

This modification forms a very beautiful sky, sometimes exhibiting numerous distinct beds of these small connected clouds, floating at different altitudes.

The cirro-cumulus is frequent in summer, and is attendant on warm and dry weather.

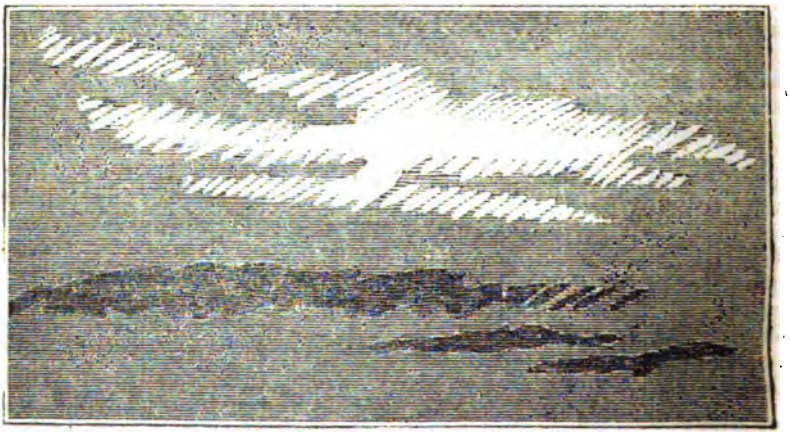


It is also occasionally and more sparingly seen in the intervals of showers, and in winter.

It may either evaporate or pass to the cirrus or cirro-stratus.

Of the Cirro-Stratus.—This cloud appears to result from the subsidence of the fibres of the cirrus to a horizontal position, at the same time that they approach towards each other laterally. The form and relative position, when seen in the distance, frequently give the idea of shoals of fish. Yet in this, as in other instances, the structure must be attended to rather than the form, which varies much, presenting at other times the appearance of parallel bars, interwoven streaks, like the grain of polished wood, &c. It is always thickest in the middle, or at one extremity, and extenuated towards the edge, as represented by the following figure.

The distinct appearance of a cirrus does not always precede the production of this and the last modification.



The cirro-stratus precedes wind and rain, the near or distant approach of which may sometimes be estimated from its greater or less abundance and permanence. It is almost always to be seen in the intervals of storms. Sometimes this and the cirro-cumulus appear together in the sky, and even alternate with each other in the same cloud, when the different evolutions which ensue are a curious spectacle, and a judgment may be formed of the weather likely to ensue, by observing which modification prevails at last. The cirro-stratus is the modification which most frequently and completely exhibits the phenomena of the solar and lunar halo, and (as supposed from a few observations) the parhelion and paraselene also. Hence the reason of the prognostic for foul weather, commonly drawn from the appearance of the halo.

Of the Cumulo-Stratus.—The different modifications which have been just treated of sometimes give place to each other,

at other times two or more appear in the same sky; but, in this case, the clouds in the same modification lie mostly in the same plane of elevation; those which are more elevated appearing through the intervals of the lower, or the latter showing dark against the lighter ones above them. When the cumulus increases rapidly, a cirro-stratus is frequently seen to form around its summit, reposing thereon as on a mountain, while the former cloud continues discernible in some degree through it. This state continues but a short time. The cirro-stratus speedily becomes denser, and spreads, while the superior part of the cumulus extends itself and passes into it, the base continuing as before, and the convex protuberances changing their position, till they present themselves laterally and downward. These are well represented by the following figure.

More rarely the cumulus alone performs this evolution, and its superior part constitutes the incumbent cirro-stratus.

In either case a large lofty dense cloud is formed, which may be compared to a mushroom, with a very thick short stem. But when a whole sky is crowded with this modification, the appearances are more indistinct. The cumulus rises through the interstices of the superior clouds, and the whole, seen as it passes off in the distant horizon, presents to the fancy mountains covered with snow, intersected with darker ridges, and lakes of water, rocks, and towers, &c.

The distinct cumulo-stratus is formed in the interval between the first appearance of the fleecy cumulus and the commencement of the rain, while the lower atmosphere is yet too dry; also, during the approach of thunder storms; the indistinct appearance of it is chiefly in the longer or shorter intervals of showers of rain, snow, or hail.

The cumulo-stratus chiefly affects a mean state of the atmosphere as to pressure and temperature, but in this respect, like the other modifications, it affords much room for future observation.

Of the Nimbus, or Cumulo-Cirro-Stratus.—Clouds, in any of the preceding modifications, at the same degree of elevation, or in two or more of them, at different elevations, may increase so as completely to obscure the sky, and at times put on an appearance of density, which, to the inexperienced observer, indicates the speedy commencement of rain. It is nevertheless extremely probable, as well from attentive observation as from a consideration of the several modes of their production, that the clouds, while in any one of these states, do not at any time let fall rain.

Before this effect takes place, they have been uniformly found to undergo a change, attended with appearances sufficiently remarkable to constitute a distinct modification, which is represented by the following figure, called the Nimbus, or Cumulo-cirro-stratus cloud. (See next page.)

In this figure a shower is represented as coming from behind an elevated point of land.

The nimbus, although in itself one of the least beautiful clouds, is yet now and then superbly decorated with its attendant, the rainbow, which can only be seen in perfection when backed by the widely extended uniform gloom of this modification.

The relations of rain, and of periodical showers more especially, with the varying temperature, density, and electricity of the atmosphere, will probably now obtain a fuller

investigation, and with a better prospect of success than heretofore.

Remarks on the Rival Claims to the Introduction of Steam Navigation. [From the London Mechanics' Magazine.]

SIR,—It must be evident to every one, that not only England, but the whole of the civilized world, is under immense obligations to the individual who first rendered steam available to the purposes of navigation. Public opinion, however, seems still to vibrate between the conflicting claims to this honor put forward by the late William Symington, Mr. Miller, of Dalswinton, (or rather by his representatives on his behalf,) and Mr. Jas. Taylor. As to those of Fulton* and Bell, they seem, according to common consent, to be wholly untenable.

We will, if you please, begin "wi' the laird" first. Mr. Miller was a man of property, possessed of an active mind, which was constantly requiring excitement. He was, therefore, always ready to enter into any experiments which promised to afford him that mental stimulus congenial to his feelings. He was, consequently, very ready to assist with his patronage young men who possessed inventive genius, or supposed that they were so blessed, and, of course, was very commonly disappointed. As he was easily induced to begin experimentalizing, he was just as apt to quit it without carrying it on to a successful result. For, although not deficient in wealth, he lacked that spirit of perseverance from which alone success can emanate.

Taylor was a tutor in this Mr. Miller's family. He had been on terms of intimacy with William Symington, when at the University of Edinburgh, and had seen a model of an improvement which Symington (though then still a very young man) had just perfected in the steam engine. In consequence, it would seem, of some mention made to Mr. Miller of Symington, (very probably by Taylor,) Mr. Miller, early in 1786, called upon Symington, who was then in the employment of, and residing with, Mr. Gilbert Meason, the manager of the Wanlock-Head Mining Company, and after conversing with him for some time, engaged him to make some experiments, for the purpose of ascertaining the practicability of propelling boats by steam. Miller himself had, previously to this, attempted to move boats by means of wheels, set in action by treddles, a plan which he was compelled to abandon from the excessive fatigue it occasioned to the men employed. This scheme, by the way, had not even the charm of novelty to recommend it, for it had been practised by the Romans, who used oxen to work machinery; and also by Savary, who had, like Mr. Miller, exerted human force for that purpose.*

The biographer of Taylor, in "Chambers' Journal," states that he "attended the University of Edinburgh for several years;" that the classes selected by him were anatomy, surgery, and chemistry; and that he "prose-

* We shall shortly have something more to say on this subject. Fulton most certainly had some claims: to what extent we shall examine shortly.—[ED. AM. M. M.]

* Mr. Miller seems to have had a predilection for appropriating other persons' inventions to himself; or, if he had not, his friends have endeavored to do so for him, as they would willingly have us to believe that the piece of sea ordnance, known as the carronade, was the first of Mr. Miller's genius, when, in fact, it was invented by Mr. Gascoigne, one of the proprietors and managers of the Carron Iron Works, from which circumstance it derived its name.

cuted his studies with much assiduity and success, for at the end of his course he was prepared to enter *either* upon the profession of medicine or divinity"!! Now, if the College Album be an authority to be confided in, Taylor matriculated for *one* season only, and attended the classes above mentioned for one course each. "One swallow," says the adage, "does not make a summer;" but according to Taylor's biographer, one course of lectures fully qualified him to be either a physician or a divine? I make no doubt that he was just as well qualified for the one as the other—that is, not at all. I agree with the writer in "Chambers' Journal," that his genius was excursive, and that to a very considerable extent; but I have yet to learn, that its excursions were ever attended by any beneficial result. He is said to have had a predilection for mineralogy, geology, and mechanics; but if this were true, how comes it that Taylor, being at the University where those subjects were treated upon scientifically, never availed himself of so excellent an opportunity of attending the classes in which they were taught?

The improvement of the steam engine, devised by Mr. Symington, was accomplished in 1785–1786, and it was in the spring of 1786 that Mr. Miller, as already mentioned, engaged him to carry on some experiments upon steam navigation. These were made upon the lake at Dalswinton, Mr. Miller's property, in 1788. It is asserted that Mr. Taylor remained in Edinburgh after Mr. Miller had left, to superintend castings of the parts of the engine intended to be employed in moving the boat. But if this were necessary, why did not Taylor afterwards put the engine together? If he were capable of furnishing the drawings and models by which the various parts were to be constructed, surely there could be no necessity for sending for Mr. Symington from the Lead hills, to put the different pieces properly "*in situ*." Mr. Miller would have been little less than mad to employ Symington in these experiments, when he had such a brilliant and inventive genius as Taylor residing under his own roof. If (as has been asserted) Taylor was the author of these experiments, where are the drawings and documents to substantiate his claim? Have they ever been seen by any person? Or, indeed, have they ever existed, except in the imagination of his partisans?

There is an account of these experiments to be found in the "Scots Magazine" for 1788, which it has been allowed was drawn up by Taylor himself. He acknowledges, in this statement, that the merit of the expense of trying the experiment was due to Mr. Miller, but that the engine used upon the occasion was the sole invention of Mr. Symington, and throughout the whole account he never introduces his own name, either directly or by implication. The notice alluded to is subjoined.*

In 1789, Taylor is represented as being located at the Carron Iron Works, for the purpose of superintending the castings of an engine of increased size, the cylinders being 18 inches in diameter. But in opposition to this, we have the affidavit of Mr. Stainton, one of the managers of these works, who states that—

"He (Taylor) was never considered capable of superintending the work; that he never furnished a single drawing or model by which the work might be forwarded; but that, on the contrary, Mr. Symington was looked up to as being the person to whom all the necessary inquiries for the completion of the engine were to be addressed; and that, so far from considering Taylor as a principal, he was rather looked upon as a spy, appointed by Miller to watch Symington's conduct, that he did not waste too much of his time upon some experiments he was conducting at the same moment for the Wanlock-Head Company."

The experiments with the new engine succeeded entirely; but when it had arrived at that point, that by a little more exertion it might have been perfected, Mr. Miller's excitement was over. He had been bitten by an agricultural mania, dismantled the steamboat, and left steam navigation to be promoted by other hands.

In 1801 and 1802 Mr. Symington renewed his experiments under the patronage of Lord Dundas, that nobleman having purposely gone down from London to engage him. He continued them until 1803, when he completed a steam tug, which towed two merchant vessels 19½ miles upon the Forth and Clyde canal, against the wind, in the presence of many spectators. Mr. Symington

* "On October 14 a boat was put in motion by a steam engine, upon Mr. Miller of Dalswinton's piece of water at that place. That gentleman's improvements in naval affairs are well known to the public. For some time past his attention has been turned to the application of the steam engine to the purposes of navigation. He has now accomplished, and evidently shown to the world, the practicability of this by executing it upon a small scale. A vessel 25 feet long and 7 broad was on the above date driven with two wheels by a small engine. It answered Mr. Miller's expectations fully, and afforded great pleasure to the spectators. The success of this experiment is no small accession to the public. Its utility in canals, and all inland navigation, points it out to be of the greatest advantage, not only to this island, but to many other nations of the world. *The engine used is Mr. Symington's new patent engine.*"—[Scots Magazine, Nov. 1788, p. 566.]

took out a patent in the usual way for the protection of his invention in 1801; and this fact must dispose of the charge of his having practised any concealment or secrecy with regard to the matter.

A letter has been published, from Mr. Symington to Taylor, in which the former promises to make over half the profits of the invention to the latter. This originated, I am told, in a representation made by Taylor, that he was possessed of considerable influence amongst noblemen and members of parliament, through whose intercession a parliamentary grant might be obtained. But even supposing Mr. Symington was not entitled to the honor of being the first applier of steam to the purposes of navigation, Taylor, from his own showing, and from that of his friend, must have still less claim; for he states, that he (Taylor) called upon Mr. Miller, and endeavored to persuade *him* to secure the right to the invention by a patent. If it was Miller's invention, Taylor's regretting his own incapability of securing the right by patent is an absurdity.

Taylor's real friends cannot be much obliged to Mr. Chambers for his biography, for it certainly exhibits him in any thing but an amiable point of view. We find him, in the first place, acting as a spy upon his intimate friend Symington, and afterwards engaging in a secret correspondence with his patron Mr. Miller's most intimate friends, for the purpose of robbing him of the fruits of his experiments, by taking them away to a foreign country; and this he did after having vainly endeavored to make Miller as dishonest as *he* wished to be, in taking out a patent to secure to himself the profits of another man's genius.

If Mr. Symington had not expended his private fortune previously to 1815, and which he did in experimentalizing, there would not have been any occasion for this letter, as there would have then been ample legal proof on record of the originality of his invention. I am, sir, yours obediently,

CH.

London, May 28, 1834.

[We have great pleasure in inserting the preceding communication, because, though it contains little that is new on the subject of Mr. Symington's claims, and puts some points less forcibly than has been already done in our pages, (see particularly vol. xix. p. 121,) it is the spontaneous production of a physician who holds a high place in public opinion, and serves to show these claims are gaining ground among those enlightened and reflecting classes of the community with whom the decision of all such matters must ultimately rest. We feel persuaded that the time is now but little distant, when we shall have to congratulate the family of Mr. Symington on the complete and triumphant recognition of his title to be regarded as the first person who practically demonstrated the immense benefits to be derived from the application of steam power to navigation —ED. LOND. M. M.]

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 72.]

MISCELLANIES.

Q. How are *Artificer's works* appreciated in the Metropolis?

A. At *fair measure and value prices*, agreeably to a given standard.

Q. What are the walls of houses principally built of in town?

A. Bricks—known of different qualities, as *common place, grey stocks, pickings, seconds, marles, cutters, paviors, &c.**

Q. How are bricks worked?

A. In headers or stretchers, laid either in *Flemish bond* or *English bond*.

Q. What is Flemish bond?

A. Bricks laid alternately in a course—first a stretcher, then a header—which is the general custom.

Q. What is English bond?

A. When one course of bricks is stretchers, and the other course headers, and so on alternately.

Q. How is brickwork measured and valued?

A. By the *rod*.

Q. What are the foundations of brickwork called?

A. Footings.

Q. What are *reveals?*

A. External recesses of four inches thick, formed by the recess of the window frames. Sometimes there are double reveals introduced, which become ornamental.

Q. What are *gauge arches?*

* The making of bricks deserves record—Kent and Essex claim precedency over all other counties in the art. In the first instance, clay and chalk are collected in large quantities, and brought to the *pug mill* (a large vat) placed in a circular excavation, in which an iron spindle with horizontal blades is fixed, and from which spindle a shaft projects, having a horse harnessed, and travelling round grinds the soil, which, emptying itself into the excavation, at the same time water is pumped therein, forms a liquid, and passing through a grating falls into a large *back* prepared for the purpose. Here the mixture is allowed to remain until it becomes a solid body. A certain portion of ashes is then strewed over the surface, and mixed with the same, which is again brought to the pug mill, ground, and taken to the hands of the brickmaker, who moulds it; from him it is conveyed to the *hacks* (prepared level surface of earth,) where the bricks are all disposed in long ranges, and in two lengths transversely, a little open to admit air, and carried to the height of four feet, where they remain from ten to twenty days, till hardened by the atmosphere and sun. They are then regularly disposed on a large area of level ground, with *breeze* (fine cinders) laid on the surfaces of every seventh or eighth tier, and then set on fire; hence, a pile, called a *clamp*, containing from half a million to two millions of bricks, is formed, and the bricks gradually burnt and produced in such qualities as the soil and the fire have combined to effect. The best bricks, as marles, paviors, &c. have the greatest quantity of chalk. Pantiles, plaintiles, &c. are made in a similar manner.

A. They are either straight, circular, or elliptical, forming a *fascia*, and are bricks rubbed, and neatly set in putty or mortar—radiating from a given centre, and presenting their several thicknesses as stretchers and headers, or closers.

Q. What are *splays*?

A. The interior or exterior obtused angles of the sides of doors, windows, &c.

Q. What are *quoins*?

A. The external angles of the buildings.

Q. What are *ramps*?

A. Segmental or elliptical sweeps in a wall that is erected on an inclined plane, to give it nearly an equal height all along.

Q. What is *coping*?

A. The summit of the wall; the bricks being laid edgeways, presenting themselves as headers.

Q. What are *strings*?

A. Longitudinal projections of different depths, in fronts, &c. of buildings.*

Q. What are *party walls*?

A. The division walls of rows of houses.

Q. What are *chimney breasts*?

A. Brickwork projecting from the walls to form the hearth; the piers on each side are termed the *jaumbs*, through which, in upper stories, the *flues* of the chimney pass to the *shaft*, which forms the chimney.† In the internal part, the chimney breast *splays*, which is called the *wings* to the entrance of the flues, which are one and a half brick by two bricks square.‡

Q. What is *nogging work*?

A. Brickwork laid between the partition framing, and is worked in brick of four inches thick, agreeably to the partition frame.

Q. What is *pointing* of brickwork?

A. The filling up of the joints of brickwork, denominated *flat joint* in the common manner, or *tuck jointed*, done with cement, in a superior manner, over grey mortar.

Q. What is meant by *scaffolding*?

A. The erection of spars, called *scaffold poles*, around the buildings, which are severally lengthened by others being lashed to them by ropes, as the work is carried up; and *putlocks*, the cross pieces, one end tied to the poles, and the other resting on the brick or stone work, for the purpose of laying the deals on. In large and high buildings, particularly steeples, columns, &c. great ingenuity is requisite to maintain sufficient strength in the unison of these parts. *Guys* or ropes are frequently had recourse to, leading from the summit of the scaffolding to some post driven in the ground, at a distance from the building.

Q. What is meant by the *carcase* of a house?

A. Simply the stone or brickwork, with the roofing, joists, and partitions.

Q. How are *sewers* or *drains* constructed?

A. With bricks or stones, in various arches—as semi-circular, elliptical, scheme, square, &c. The lesser drains are circular, and denoted as *gun-barrel drains*. Their constructions are liable to Acts of Parliament.

PLASTERER.

Q. What is plasterer's work?

A. The plastering of a building internally wants several coats, denominated *rough rendering*, being the first coat of plaster on walls—*floated rendering* the second coat, of fine lime and hair—and *set work*, the third coat, *fine stiff*, part lime and sand. On partitions and ceilings, *lath and plaster and set*, or *floated lath and plaster set*.

Q. How are the best rooms finished internally?

A. The walls are *trowelled stucco*, i. e. plastered with fine lime and sand, and lime water, with the smoothest surface.

Q. How are external walls finished?

A. Sometimes *rough cast*, (a rough plaster thrown thereon, called *slap-dash*,) but frequently *rough stuccoed*, presenting the appearance of stone work, with rustics, &c.

Q. What is *lime*?

A. A viscous substance, and is known as *chalk lime* and *stone lime*. The former partakes of two qualities, as *flame lime*—the chalk being burned in large lumps, in kilns, by furnaces beneath, heated with coals, and is of a much stronger nature than the *tunnel lime*, burnt in a tunnel kiln, in small pieces of chalk, mixed with culm, cinders, breeze, or ashes, in equal proportions. *Stone lime* is burnt with coals, or culm, in kilns, and is of greater strength than either.

Q. What is *mortar*?

A. Lime and sand,* mixed in equal pro-

NOTE.—Walls are said to *batter* when the external face at the base projects and diminishes upwards to any given height, and then carried up perpendicularly, as batteries, &c. The proportion is one inch in a foot.

* Cornices, pilasters, plinths, strings, sills, &c. are frequently worked in bricks.

† In large buildings all the flues of the several chimneys are brought to the centre shaft, the same being sprung by arches from their respective chimney breasts.

‡ An Act of Parliament was passed in 14 Geo. III. cap 78, entitled "An abstract of the London Building Act," dividing buildings into seven classes, regulating all party walls, chimneys, &c.

* Lime, a very useful earth, which absorbs moisture and carbonic acid, and exists as lime stone, and in marble and chalk, which when burnt becomes lime. It consists of oxygen and a metallic base called calcium. It fixes the gaseous constituents of water, which in losing their motion transfer it in great heat to surrounding bodies. In its native state it is called carbonate of lime, and burnt to disengage the carbonic acid. When made into a paste of one

portions according to the strength of the former, with water, and is used for laying of stones, bricks, plastering, &c.

Q. What is *Roman cement?*?

A. A composition of lime and earth, by which all external ornaments, as sills, pilasters, cornices, rustics, &c. are worked.

Q. What are *Terras* and *Pozzolona?*

A. Terras is a volcanic production, consisting chiefly of clay and oxide of iron, indurated together. Pozzolona is another volcanic production, differing but little from the former. It is thrown out of volcanoes in the form of ashes, and abounds in the kingdom of Naples. The cement used in the construction of the Eddystone lighthouse is composed of equal parts of lime and pozzolona, as best adapted for marine purposes.

Q. What is *Plaster of Paris?*

A. *Burnt gypsum*, a combination of 42 parts of lime and 58 of sulphuric acid, with which all enrichments for cornices, soffits, fretts, flutings, festoons, husks, flowers. &c. are cast, and attached to the ceilings.

CARPENTER.

Q. What is carpenter's work?

A. The rough timber work, as *girders*, severally introduced into large buildings, to support the joists; *oak joists* and *sleepers*, for the ground floors; *wall plates*, to receive the ends of joists on, which are framed by *trimmers* to fire places, and the *well holes* of staircases. *Lintels*, (generally oak,) thrown over all apertures, to receive any contingent pressure. *Bond timber*, worked longitudinally into walls, to give additional strength, and receive any fastenings. *Quarter partitions*, framed, consisting of *heads*, *sills*, *quartering*, *enterties*, *braces*, *puncheons*, &c. stretching across the joist; or *skeleton partitions*, simply, quartering nailed to the joist, without heads, sills, &c. The roofing of the building, with *binders*, *ceiling joist*, also *brest summers*, for shop fronts, and *story posts* to support the same, all *luffer boarding*, or *weather boarding*, together with *cradling for centres*, &c. Also *fencing* to parks, and *rough work* in general.

JOINER.

Q. What is joiner's work?

A. The completion of the wood-work in the several houses, as laying of floors, making doors, window frames, sashes, shutters, &c.

Q. How are floors designated?

A. According to the quality of timbers used—as rough-inch deal, white or yellow edges, shot (*i. e.* planed fair); inch-wrought folding white or yellow, (*i. e.* several deals are laid within certain breadth and secured by dogs, and are then pressed down by weight, uniting the joints very compactly and closely;) inch deal (white or yellow) straight joint, (*i. e.* all the joints running in fair lines, the deals being of equal breadth;) inch floor, (white or yellow,) ploughed and tongued headings, edges nailed, (*i. e.* the extremities of the boards, at the hearths, &c. are grooved into a piece running at right angles, making the whole fair;) whole deal dowelled floor, (*i. e.* when the edges of the boards are shot or made fair, small holes are bored into their close sides, and wooden pins or dowels are introduced when the same are united together.) Other floors, for granaries, &c. are ploughed or rebated, and feather-tongued, (*i. e.* when one edge laps over the other about three quarters of an inch, and tongues introduced into each side, similar to dowelling;) straight-jointed batten floors, (from 4 to 7 in.) grooved and tongued. The best floors are sometimes of oak or wainscot.

Q. How are windows made and denominated?

A. The frame is case-work, to admit of the weights, and divided by *stops* for the sashes to traverse in; the lower part of the frame is of oak—solid; the sashes are made to fit the aperture of various thicknesses, and moulded bars: hence, in measuring such work, it is said, four-inch deal cased frame, oak-sunk sill, two-inch astragal and hollow bars, (or otherwise,) hung double, (or single,) with pulleys, weights, lines, &c.—or, two-inch French casements with circular heads, hung folding, with marginal spaces, &c. (Frame measured separately.)*

Q. How are doors made?

A. In different pieces. The perpendicular parts are the *hanging stile*, to which the

part water with three parts lime, it is called hydrate of lime; and being mixed with silica, alumina, and oxide of iron, it forms plastic cements, and mortars; and afterwards imbibing carbonic acid from the atmosphere, it becomes again a carbonate of lime, as hard as at first: and hence it is used in building. *Slake lime* is so called when it has been wet or damaged. The tunnel lime is much used in the eastward for manure, as also the stone lime in the westward. Northfleet, in Kent, and up the river Medway, are places noted for chalk lime. Chalk, carbonate of lime,—56 lime, 44 carbonic acid, when pure. Sand is pulverized rocks of silex, &c. and it is known as *clean* or *round* sand, and *sharp* sand, which consists of grains with flat surfaces, and when enveloped and cemented together by the lime paste, possesses much stronger power of cohesion than the globular, and is taken out of the Thames above Woolwich.

* The laws of symmetry and strength alike require windows to be exactly one over the other; although our ancestors deviated so strangely. To determine the aggregate area of the windows proper to be made in an apartment, extract the square root of the curvature of such apartment, and the quotient will be the answer. Nor should the apertures be made too high, as the effect of cornice, architrave, &c. is totally destroyed. The number of windows depend on the strength, local position, and elevation of the building.

hinges are affixed—the *closing stile*, to which the locks, &c. are affixed—and the *muntins*, the central pieces. The horizontal pieces are *top rail*, *second rail*, *middle rail*, and *bottom rail*; they are all grooved to secure the *panels* in the intermediate spaces, which are moulded, raised, &c. Doors vary in thickness, from three inches to one, and descend from the most ornamental door down to the common ledged door.*

Q. What are shutters?

A. They differ, like doors, in construction and size. In respectable houses they are fitted in *proper boxings* (*i. e. casings* with *linings*, &c.) and hung with *back flaps*, whilst the *soffits* of the windows, the *backs* and *elbows* (the parts beneath the windows,) correspond in panelling and mouldings. The architraves to the windows finish the internal part of the window, with which those of the doors, recesses, &c. should assimilate. Closet doors, dwarf closets, and doors, should be made the same.

Q. What are door cases?

A. The frames of doors, and are known as *proper door cases*, *double* or *single rebated*, *&c.* one side or both sides.

Q. What are skirtings?

A. The boards in the lower part of rooms or lobbies, staircases, &c. finishing the flooring and the plastering of the wall. They are designated according to their mouldings as *torus*, *double torus*, *reeded*, *&c.* and are either *raking* or *straight*.

Q. What are *surbases?*

A. Mouldings running round the room as a protection to the wall. The intermediate part is termed the *dado*—sometimes panelled, and sometimes plastered.†

Q. What of *staircases?*

A. They are of several forms, arranged according to conveniency, neatness, or grandeur of appearance: these come under the head of *plain* or *straight*; *dog-legged*, (*i. e.* having, halfway up, a landing called a *quarter space*, or *half space*, if twice the size, from whence the flight is continued the opposite way); *elliptical*, *circular*, (all the stairs being winders), *geometrical*, &c.‡

Q. What are the component parts of a staircase?

A. The *treads*, the flat spaces, (if straight, designated *flyers*; if angular, *winders*;) the *risers*, the perpendicular parts of which support the treads; the *strings*—as wall-string, the string into which the treads and risers are framed; the *carriage*, pieces of quartering running longitudinally under the stairs, to support them; *quarter and half spaces*, *hand-rail newels*, and *balusters*. In superior staircases, of whatever figure, they come under a different denomination, as *risers*, and *treads*, with *rounded* and *moulded nosings*, framed to *wall-string*, with *cut string*, *returned* and *mitred ends*, and *moulded brackets*; mahogany *hand-rail* ramped with *curtail step* and framed *balusters*; carved *newels* with *pendants*, *&c.*

Q. What else come under notice in joinery?

A. Framed closet fronts, with doors for chambers and kitchens, framed spandrils for staircases, plain linings, window-boards, kitchen-dressers with drawers, pot-boards, cut brackets and shelves, fascias, mantel-pieces, shoots, and water-troughs, catilivers and balcony bottoms, verandas, with canopies, trellis-work, &c.

Q. What are the several mouldings used in joinery for skirtings, architraves, and windows?

A. 1, rounded. 2, ovolo. 3, cavetto. 4, quirked bead, or bead and quirk. 5, bead and double quirk, or return bead. 6, double bead, or double bead and quirk. 7, single torus. 8, double torus. 9, cima recta. 10, cima reversa. 11, quirked ogee. 12, quirked ovolo. 13, scotia. 14, single reed. 15, double do. 16, triple do. 17 and 18, reeds round convex surface of a cylinder. 19, astragal and half-round bar. 20, quirked astragal bar. 21 and 22, quirked gothic bars. 23, double ogee bar. 24, quirked astragal and hollow bar. 25, double reeded bar. 26, triple do.

Q. How are doors described?

A. 1, square and flat panel both sides. 2, quirked ovolo, fillet and flat panel, with square back. 3, quirked ovolo, bead and flat panel, with do. 4, quirked ovolo, bead, fillet, and flat panel, with do. 5, quirked ogee, quirk bead, and flat panel, with square

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* In the proportion for small doors generally three feet wide, the height is to the breadth in the ratio of 7 to 3. The height of large doors need not be more than double their breadth. The doors of mansions may be six feet wide; those of public edifices from six to ten feet wide; but these should be folding. Where two doors are thrown into one, by folding doors, the width of the aperture is generally of less height than twice its breadth.

† In genteel houses, the skirting and surbase are superseded by a deep *plinth*, with a rich moulding running on the top of it.

‡ The fixing the situation of a staircase, and deciding the form of the same, affords one of the strongest proofs of an architect's skill. In mansions and palaces, the steps should not be less than four, nor more than six inches high; nor more than eighteen, nor less than twelve inches broad; the width should not be less than six, nor exceed fifteen feet. In ordinary houses, the steps average from six to seven inches high, twelve inches wide, and three feet long. In setting off the staircase, of whatever form, calculate the height from one floor to the other, reduce the same to inches, and divide by the height of the steps, the number of steps will be given. Care must be taken to admit of sufficient height for door-ways, over which they may be thrown.

back. 6, cove, raised bead, and flat panel with square back. 7, quirked ogee, raised bead, and flat panel with square do. 8, quirked ovolo, bead, fillet, and raised panel on front, with square back. 9, quirked ovolo, bead, and raised panel with ovolo on the rising on front of door, with square back. 10, quirked ogee, raised panel, ovolo, and fillet, on rising, and astragal raised on the flat of panel and square back. 11, quirked ovolo, bead and fillet, and flat panel on both sides. 12, bead and but front with square back. 13, bead, flush front, and quirked ogee, raised panel with ovolo on the rising ground on flat of panel on brick. 14, Bilection moulded door.*

STONE-MASON.

Q. What are the different stones used in building?

A. Portland, Bath stone, Yorkshire, and Purbeck; to which may be added, stone found in neighboring districts, as granite, lime stone, and slate; all of which, according to the several purposes, are measured by the foot *cube* (solids above four inches thick); *super* (to all squares and flat surfaces under four inches, as *landings*, &c.); *lineal* (to grooving, throating, Yorkshire and Purbeck steps, and channel stone).

Q. For what purposes is stone used?

A. In some instances throughout buildings, and also for bridges—and columns—in others, for casing fronts of buildings: hence termed *ashlar fronts*—also for paving, plinths, strings, sills, steps, quoins, keystones, copings, parapets, mantel jaumbs, hearths, sinks, &c.†

Q. What are the different kinds of marble?

A. There are several; namely, *statuary*, (the most valuable,) *veined*, *dove*, *black and gold*, *black*, *speckled*, *sienna*, and *Elgin*.

Q. For what is marble appropriated?

A. For tombs, monuments, pavements of halls, (being tesselated, giving a pleasing effect,) sometimes columns, grouping, &c. and for mantel-pieces.

Q. How is stone-work secured?

A. It is bedded in mortar or cement, and frequently cramped by small pieces of iron being let in, and bedded in lead.

PLUMBER.

Q. What does plumbers' work embrace?

A. The leading of roofs, gutters, cisterns, pumps, pipes of several sizes, solder, &c. all of which is measured by the square and lineal foot. It also includes fittings to water closets, as stop-cocks, bibbs, stop-bibbs, balls, ball-basses, butts, ferrols, washers and wasters sockets, plugs, &c.

PAINTER.

Q. How is painters' work described?

A. It is done in one, two, three, and four oils, in different colors and shades—imitations of wainscot, oak, satin wood, &c. and then *flatted* by turpentine—all being previously *knotted*.

Q. How is painter's work measured?

A. Wherever the brush goes: all wainscot, dado, doors, window-shutters, jaumbs-linings, mouldings, architraves, &c. are measured by the *yard square*. Chimney pieces, ornamented ceilings, and other enriched, worked, picked in, and small detached pieces, done with variegated or fancy colors, &c. by the *foot square*. Ornamental figures, carved mouldings, cornices, fascias, skirting, water-trunks, &c. by the *foot running*. Sash frames, window-lights, casements, &c. per *piece*; and sash squares by the *dozen*.

GLAZIER.

Q. What is glaziers' work?

A. The glazing of all windows, which is measured by the foot superficial, from rebate to rebate.

Q. What are the different qualities of glass?

A. Plate glass, best Newcastle crown glass, second do., third do, packing and green glass, and ground glass.

BLACKSMITH.

Q. How is blacksmiths' work charged?

A. By the *hundred weight*, namely, 112 pounds, to doors, columns, &c.; by the *pound* to smaller weights; by the *foot lineal* or *super* to railings, balconies, trellises, &c.

NOTE.—Iron-wrought doors, with panels, &c. are directed by Act of Parliament, for dividing large warehouses and stables.

Q. What branches of science are immediately connected with architecture?

A. A knowledge of the classics, the acquisition of geometry, and perspective, and the art of drawing; but above all, to be well skilled in the properties of the materials used—the proper combination of such—and lastly, a due regard to the several conveniences and arrangements of the rooms, according to the purposes of the intended building.

* These mouldings are applicable to shutters, and all panelling. The common ledged, beaded, and braced door is simply boards put together, with transverse and diagonal pieces at the back.

† Walls built with unhewn stone, or without mortar, are called *rubble walls*, which are of two kinds—coursed and uncoursed. In the former the stones are hammer-dressed or axed, each row forming a horizontal face: in the latter they are used nearly as produced from the quarry. The stones which run through the thickness of the wall are called *bond stones*. In *ashlar fronts*, great care is requisite to bind the facing with the rubble or the brick behind.

SAFETY OF LEAD PIPES PROTECTED BY TIN.—Extract of a letter from Mr. G. Chilton, dated New-York, June 23, 1834.

Dear Sir,—Observing, in a late number, a notice of Ewbank's *patent* tinned lead pipes, and having had many applications for information concerning the danger attending the use of metal pipes for conveying water, beer, cider, &c., I have been induced to subject the pipes of Ewbank to a few trials, for the purpose of ascertaining whether, from the occasional contact of acids, any deleterious solution of lead would attend their ordinary use. It is well known, that the common beer pump, with a leaden pipe, has frequently given to the liquor a dangerous impregnation, especially after remaining stagnant for a time, and the beer in a sour state. The substitution of block tin would remove the apprehension of danger, but its greater price offers a strong temptation to the use of lead. It appears to me that the lead tube lined with tin will answer the ends of cheapness, safety, and durability. I would therefore invite your attention to the following experiments, which, if you think them of any importance to the public, you may insert in your Journal.

Experiments.—Various portions of lead tube, coated, some with pure tin, and others with different alloys of tin and lead, were bent into the form of a semi-circle, and filled with vinegar of different degrees of strength. After standing, some a month, and others six weeks, with occasional disturbance, the clear solutions were tested, first with sulphate of soda, and afterwards with bi-hydro-sulphuret of ammonia. The application of the first of these tests, namely sal. soda, produced no alteration in any of the solutions, from which it must be inferred that they contained no lead.

The application of the second test produced, as was anticipated, a brown precipitate of sulphuret of tin. In the same manner, two fresh pieces of tube were filled with a strong solution of common salt, which remained in contact for some time. The solutions, when assayed with the same tests, showed that nothing but a little tin was dissolved.

It appears that in all these cases, which I regard as galvanic effects, the tin was the most oxidable metal, although, when not under the influence of polar arrangement and in the open air, lead appears to oxidate sooner than tin. It is scarcely necessary to remind you that results similar to these were obtained thirty years ago by the celebrated Professor Proust, at Madrid, who undertook for the Spanish government an extensive series of experiments on the different alloys of lead and tin, with the express view of determining whether the popular prejudices against the coating of copper vessels with an alloy of tin and lead, which is the common practice, was ill or well founded. Nothing can be more satisfactory than the conclusions he drew from his labors, namely, that as, in all his numerous experiments, neither lead nor copper were dissolved, there is little reason to fear the solution of lead from the tinning of our kitchen utensils. I may just mention here, that I am in the habit of cleaning out my soda fountain every spring with dilute muriatic acid, which uniformly dissolves the oxide of tin without touching the copper, which I am persuaded will remain as securely as the sheathing copper in Sir Humphry Davy's great experiment, and for the same reason.—[American Journal of Science and Arts.]

DISCOVERY OF SILVER ORE IN THE OURAL MOUNTAINS. — The Oural chain has been for several years well known to Europe for its rich gold and platina ores. A discovery has now been made of rich silver ore in two places. The first is seventy wersts from the foundry of Nischneitagilsk, near to the confluence of the little River Graesnoy with the Tagil, where gold also occurs; the other is twenty-two wersts from the foundry of Nischneitagilsk, on the little River Ulka.

On the Location of Railroad Curvatures; being an Investigation of all the Principal Formulas which are required for Field Operations, in laying Curves and Tangent Lines, to pass through Given Points. By J. S. VAN DE GRAAFF. [From the American Railroad Journal.]

ART. 1.—When it becomes necessary for a road to pass from a right line into a curve, the former should in all cases be laid tangent to the latter. It is, however, unnecessary, in ordinary roads, to adhere to this principle with the rigor of an accurate geometrical construction; but with reference to a railroad, it should be observed with the greatest care and precision, *as well as the general selection and distribution of the various curvatures.* This is an obvious consequence of the well known law of *inertia;* for any two points being fixed, in the general direction of a route, through which it is proposed to lay a line of railroad composed of several curves and intervening tangents, the cost of construction is in most cases not the only requisite datum to fix the definite location of the intermediate points.

There are, indeed, very few varieties of ground, except in a very broken country, which will not admit of several different lines, connecting the same points, all at nearly an equal expense of construction, and all within the same *limits* of curvature. It therefore becomes an object to make such a selection of

right lines and curves, and such a distribution thereof, as will produce, *at a given expense*, the most efficient road.

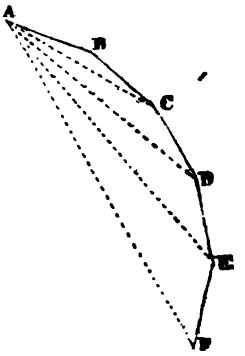
The effect of curvature, upon the *cost of transportation*, does not fall within the present subject; and the only general rules which can, therefore, be here given, as a guide for the arrangement of a line, are the following: Endeavor to open the closer curves by increasing their length, or by increasing the length of some of those which have a greater radius, or by giving some tangent line a different direction. But a sufficient dexterity in the judicious arrangement of the curvatures of a line can only be had from experience; and the principal object which is here proposed is an investigation of the various formulas which are required in facilitating the operations in the field.

2. In order to obtain results which are of commodious application in the field, it is necessary to use only circular arcs for curves; but when the situation of the ground is such as to render a continuous arc of the same curvature inapplicable to the purposes required, a curvilinear line may nevertheless be traced in such a manner as to take any desired form, in order to pass through any number of designated points, by merely connecting together a succession of circular arcs, having different *radii of curvatures*. To make a good selection in the field, for those different circular arcs, requires skill and judgment; but the only additional care to be observed in the operations of tracing such a selected line, will arise from the necessity of connecting the different arcs in such a manner as that they may have a common normal at their point of connection.

The following well-known properties of the circle exhibit the first principles which will be necessary in the subsequent inquiries.

Theo. I. The angle of deflection* between two equal and contiguous chords is measured by the arc which is subtended by either of the chords. II. If there be a tangent line, and a chord from the touching point, the angle of deflection from the tangent line into the chord is one-half of the angle of deflection between two such equal chords. III. Tangent lines from the two extremities of any arc, form equal angles with the connecting chord: each equal to one-half of the intercepted arc. IV. Any angle at the circumference, standing upon a given chord, will have a constant value for all positions of that chord upon the circumference; and this constant value is one-half of the arc subtended by the given chord. These principles are presumed to be familiar to the reader; and have been here transcribed only for the sake of convenient reference.

3. Let any number of equal straight lines, AB, BC, CD, &c., be connected together in such a manner at their extremities, that the angles BAC, CAD, DAE, &c., may be all equal to each other; it then follows from Theo. IV., Art. 2, that the points A, B, C, D, &c., will all be situated in the circumference of a circle. And this obviously suggests the common method of tracing a circular arc in the field, by means of a chain whose length is AB, or BC, or CD, &c., and an instrument for measuring the equal angles BAC, CAD, DAE, &c. It is thus easy to set as many stations in a curve as can be seen from an instrument placed at the station A. The *position* of the first chain, AB, is here taken arbitrarily, and does not effect the *curvature*.



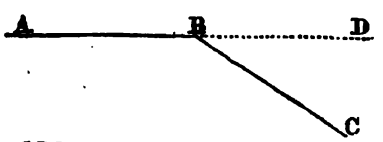
4. In using the formulas which will be deduced in the course of the present inquiry, it must be remembered that all measurements of *distance* are supposed to be made in chains, and the decimal parts of a chain. The chain will therefore be the *unity* of length, and may have any value whatever; but as this will be a constant quantity in the field, it follows, that the *curvature* of a line, traced as in the last article, can only be made variable by assuming, in succession, a different value for those equal angles BAC, CAD, DAE, &c. These equal angles will therefore be called the *modulus* of curvature, and will always be denoted by a letter T. The modulus of curvature will therefore be a constant quantity in the same curve, but variable in different curves; and any curve will be given, when its modulus of curvature is known. The letter n will be taken to denote the number of chains composing any arc which may be under consideration, and the letter D to represent the number of degrees contained in that arc. It is then obvious, from Theo. IV., Art. 2, that each chain will subtend a portion of the circumference equal to 2T; and consequently the following formula is the evident result,

$$D = n \times 2T. \qquad (I.)$$

This expression gives the number of degrees which any arc contains, when the modulus of curvature and number of chains are known.

5. In tracing a circular arc of given curvature, by means of chords of more or less than one chain in length, the particular modulus of curvature corresponding to any given length of chord will be nearly proportional to the length of that chord, when that length is only a very small part of the whole circumference. For, in this case, the length of the given chord will be nearly proportional to the number of degrees

* The angle of deflection between two lines which meet in a point, is the angle contained between either line and the other line produced.



Thus DBC is the angle of deflection between the two lines AB and BC.

in the arc which it subtends, and therefore, also, by Theo. IV., Art. 2, nearly proportional to its particular modulus of curvature.

Hence T denoting the modulus of curvature for a given curve with a chain whose length is unity, then $p \times T$ will be nearly the modulus of curvature for the *same curve* when traced by means of chords whose length is p chains. This result is only approximative; but a rigorous formula will be investigated hereafter. It is evident, upon the same principles, that (I.) is rigorous only when n is an *integer* number of chains.

6. Since each chain in a curve subtends a portion of the circumference equal to double the modulus of curvature, it follows, from Theo. I., Art. 2, that the angle of deflection between any two contiguous chains will likewise be equal to double the modulus of curvature. And it thus also obviously appears, from Theo. II., Art. 2, that the angle of deflection from any chain, into a tangent line at either of its extremities, will be equal to the modulus of curvature.

7. When a given curve contains more than one chain of the same modulus of curvature, and the direction of a tangent line at any station be required, it should never be found from the direction of the first chain at that station; for small errors will arise, both in placing the instrument vertically over one of the stations, and in taking the back sight to the centre of the other, and the angular effect of these errors will obviously diminish as the two stations are more remote. In order, therefore, to obtain the direction of a tangent line at any station in a given curve, direct the instrument into a chord, embracing a number of chains in the proposed curve, denoted by n; and it then appears, from Theo. III., Art. 2, that $\frac{1}{2}D$ will express the angle of deflection from the selected chord into the required tangent line. Hence, by Art. 4, the formula required in obtaining the direction of a tangent line is,

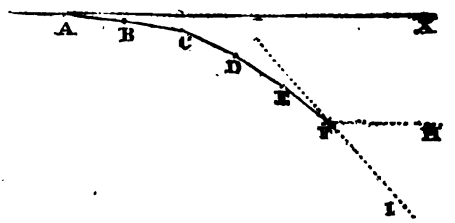
$$\frac{1}{2}D = n \times T . \qquad \text{(II.)}$$

8. The general method of tracing a curve in the field, having the modulus of curvature given, will appear from Art. 3; but it remains yet to show how such a curve may be laid to a given tangent line at a given point. It is obvious from Art. 6, that the required object will be attained by laying the first chain from the given point with an angle of deflection from the given tangent line equal to the modulus of curvature of the proposed curve. For then the same curve may obviously be continued from that first chain to any number of chains, by the method of Art 3.

9. It is frequently necessary to pass from one given curve into another, having a different modulus of curvature. When this case occurs, the instrument must be placed at the station where the change of curvature is to be made; and let it be directed into the *tangent line of the first given curve* at that station, agreeably to the method in Art. 7. The instrument may then be considered as adjusted, so as to be in readiness, either to lay a *continuation* of the first given curve, or to lay any other curve, from another given modulus of curvature, in such a manner as to have a common tangent with the first curve at the *point* where the two curves pass into each other; and it is sufficiently obvious that, in either of these two cases, the selected curve must be traced agreeably to the principles given in Art. 8.

When, therefore, a change of curvature occurs at any station, the angle of deflection between the two chains at that station will be equal to the *sum of the two moduli of curvatures.*

10. Let AB, BC, CD, &c. represent the successive chains by which a given curve, ABCD, &c., may be traced from its origin at the station A, in such a manner as to touch a given right line, AX, at that point. It is proposed to investigate a formula which will express the inclination of the given tangent line AX, to the nth chain in the given curve, estimating from the origin at the point A.



Take EF to represent the nth chain; and let the letter E denote the required inclination of the line EF to the given tangent line AX. The inclination of the first chain, AB, is expressed by the given modulus of curvature T, agreeably to Art. 6, or 8; and consequently, the inclination of the second chain, BC, will be expressed by T + 2T, or 3T. In like manner the inclination of the third chain, CD, is expressed by 3T + 2T, or 5T. Hence the inclinations of all the chains AB, BC, CD, &c. will obviously be expressed by T, 3T, 5T, &c. respectively. The problem is therefore evidently reduced to the following very simple inquiry, viz.: To find the value of the nth term of the series 1, 3, 5, 7, &c. But agreeably to the principles of arithmetic, this nth term will be expressed by $2n-1$. The desired formula will therefore be,

$$E = T \times \overline{2n-1}. \qquad \text{(III.)}$$

The expression (III.) will be frequently very convenient in the field when it is required to compute the magnetic bearing of any particular chain in a long curve, when the bearing of the given tangent line at the origin is known. If the country be free from metallic matter, and the instrument be in proper order for use, the magnetic bearing will always serve as a very useful check in detecting any material error which may have been inadvertently committed in the previous deflections. By way of a numerical illustration of this, let the given tangent line AX bear due North; and let the given modulus of curvature be 2°, to find the bearing of the 20th chain. Here $T = 2°$, $n = 20$; and therefore $E = 2° \times \overline{40-1} = 78°$; and if the

curve be supposed to bend to the left, then the bearing of the 20th chain is N. 78° W. If the observed course do not correspond with this result, some error has been committed in tracing the curve. This method of proof is so very simple, that it should be attended to frequently in tracing long curves, in order to avoid useless labor after some error may have been already committed. The magnetic bearing of a particular chain in a curve is also sometimes required in the field for other purposes.

11. Let ABCD, &c., represent a given curve traced as in the last article; and take EF to represent the nth chain estimated from the origin at the point A. It is proposed to find a method of directing the instrument, when placed at the station F, into a position parallel to the given tangent line AX at the origin of the curve.

Direct the instrument into a chord, through any of the back stations, as for instance the station C or D, (see fig. Art. 10,); and, from that chord, deflect into the tangent FI, at the station F, agreeably to the method given in Art. 7. Take D′ to denote the inclination of the tangent FI, to the given tangent AX at the origin of the curve, and it evidently follows, from Art. 6, that, $D' = E + T$; or, substituting for E its value from (III.), the following expression is at once obtained,

$$D' = 2nT \ . \qquad \text{(IV.)}$$

Hence, from the tangent FI, deflect an angle IFH equal to $2nT$; and the instrument will then have the required position FH.

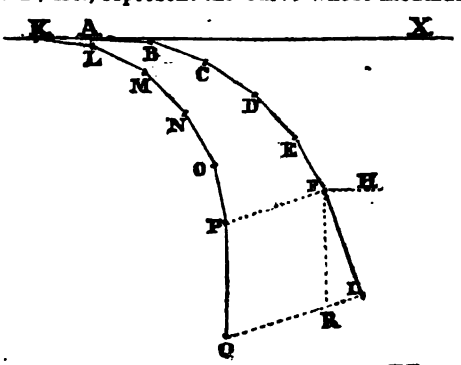
The principle which has just been explained will very frequently be highly useful in the field. For if the origin of the given curve ABCD, &c. be removed from the point A, to any other point in the tangent line AX, then the station F will be changed exactly by the same quantity, and in the same direction, upon the line FH, as will be hereafter shown.

12. Let any two curves be laid upon the same tangent line, and take T and T′ to represent the two moduli of curvatures, and let each curve pass into a tangent at the extremities of the nth and mth chain respectively. It is then proposed to determine a formula which will express the inclination of those latter tangents to each other.

Take z to denote the inclination required. From (IV.) it appears, that $2nT$, and $2mT'$, respectively, will express the inclination of each of the proposed tangents to the common tangent at the origins of the two curves; and hence the difference between the quantities $2nT$ and $2mT'$ will obviously express the value of z. The formula required is therefore the following,

$$z = 2nT - 2mT'. \qquad \text{(V.)}$$

The expression (V.) will find an application in the field in all cases where two tangents are under consideration; for in computing the rate at which any two tangents converge or diverge, their inclination to each other is, of course, the first datum required. The principles contained in (V.) and its application to different cases occurring in the field, will be more easily explained by a reference to a figure. Let A B C D, &c., represent the curve whose modulus



of curvature is denoted by T, and let EF represent the nth chain, and FI the tangent at F. In like manner let KLMN, &c., represent the curve whose modulus of curvature is denoted by T′, and let OP represent the mth chain, and PQ the tangent at P.

Draw FH parallel to KX, the common tangent at the origins of both curves; and draw, also, FR parallel to the tangent PQ. The inclination of the tangent FI, to the common tangent KX, will evidently be expressed by the angle HFI, or $2nT$; and the inclination of the tangent PQ, to the same common tangent, will in like manner be expressed by the angle HF R, or $2mT'$. Hence the angle IFR, which measures the inclination of the two tangents, FI and PQ, *to each other*, will be expressed by the quantity $2mT'—2nT$. When, therefore, the value of z in (V.) comes out *negative*, it shows that the line FR falls below the tangent FI; that is, *the two tangents in that case diverge*. When z comes out positive, the line FR will be situated above the tangent FI; that is, in such a case the two tangents PQ and FI *will converge*. It is here supposed, however, that the two curves do not intersect each other.

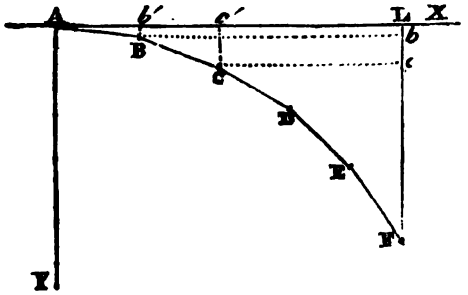
It is sufficiently obvious that the angle $2nT$ will remain the same, whatever position may be given to the origin A in the tangent line AX; and it hence evidently follows, that the distance AK, between the two origins, has no connection whatever with the inclination of the two tangents, FI and PQ, to each other. The distance AK will, however, have an effect upon the line PF, which expresses the distance between the extremities of the two curves. Supposing the distance AK, and the moduli of curvatures, with the number of chains, n and m, contained in each curve, to be all given, the line PF may be computed by methods which will be hereafter explained; and then the angle IFR, which measures the inclination of the two tangents, FI and PQ, to each other, being known from (V.), it will be easy to compute the situations of any proposed points, in those two tangents, which may come under consideration in the field, by the common methods of plane trigonometry.

When the distance PF is very small in comparison with the length of the tangents FI or PQ, and when these tangents are but little in-

clined to each other, every necessary calculation in the field may be made by means of very simple approximative methods. All this will be fully explained in the subsequent articles.

13. Let AB, BC, CD, &c. represent the successive chains by which a given curve ABCD, &c., may be traced from its origin at the station A, in such a manner as to touch a given right line, AX, at that station; and let EF represent the nth chain, counted from the origin at A.

Taking AX, and AY, for a system of rectangular co-ordinate axes, it is proposed to investigate formulas which will express the values of the co-ordinates AL and LF, of the station at F.



Put $x = AL$, and $y = LF$. The inclination of the first chain AB, to the axis of x, is found by Art. 10 to be $= T$; and therefore the projections of AB upon the co-ordinate axes will be, $Ab' = AB \cdot \text{Cos. } T$, and $Lb = AB \cdot \text{Sin. } T$. But as all lines are supposed to be measured in chains, it follows that the projections of AB upon the co-ordinate axes are, $Ab' = \text{Cos. } T$, and $Lb = \text{Sin. } T$. Again, by Art. 10, the inclination of the second chain BC to the axis of x is $= 3T$, and consequently the projections of BC upon the co-ordinate axes, are $b'c' = \text{Cos. } 3T$, and $bc = \text{Sin. } 3T$.

In like manner let each of the other chains be projected upon the co-ordinate axes; and then taking the sums of those projections, the following equations will obviously be the result,

$$x = \text{Cos. } T + \text{Cos. } 3T + \text{Cos. } 5T + \ldots\ldots$$
$$\text{Cos. } \{T \cdot 2n-1\}.$$

$$y = \text{Sin. } T + \text{Sin. } 3T + \text{Sin. } 5T + \ldots\ldots$$
$$\text{Sin. } \{T \cdot 2n-1\}.$$

The reason for writing the last term, in each of these two series, as the nth term, requires no explanation; and the *sum* of n terms of each series being taken agreeably to the known principles of analytical trigonometry, the following formulas will be the result,

$$x = \frac{\text{Sin. } 2nT}{2 \text{ Sin. } T}$$

$$y = \frac{\text{Sin. } {}^2nT}{\text{Sin. } T}. \qquad \text{(VI.)}$$

The form in which the expressions (VI.) appear is that most convenient for logarithmic computations; and it is also a form which will be required hereafter for other purposes. But for use in the field, with a table of natural sines and cosines, the expression for the value of y may have a better form. Thus, agreeably to the principles of analytical trigonometry, $2 \text{ Sin. } {}^2nT = 1 - \text{Cos. } 2nT$; and consequently the expressions (VI.) become,

$$x = \frac{\text{Sin. } 2nT}{2 \text{ Sin } T}$$

$$y = \frac{1 - \text{Cos. } 2nT}{2 \text{ Sin } T}. \qquad \text{(VII.)}$$

Such are the formulas which it was proposed to investigate. For an example in figures, let the modulus of curvature be 1°, and suppose it were required to find the values of AL and LF, corresponding with the extremity of the 40th chain. In this case, then, $2nT = 80°$; and by the table of natural sines and cosines, at the end of this volume, I find Sin. 80° = .98481, Cos. 80° = .17365, and Sin. 1° = .01745; hence,

$$x = \frac{.98481}{.03490} = 28.214 \text{ chains; and}$$

$$y = \frac{1 - .17365}{.03490} = \frac{.82635}{.0349} = 23.675 \text{ chains.}$$

If, therefore, the chain used in tracing the curve be 100 feet in length, then AL = 2821 feet, and LF = 2367 feet.

Packet Waggons.

To the Editor, &c.

For the conveyance of packets, or small packages, from one part of our country to another, the following system may be adopted. A store is selected in New-York city as a receiving, forwarding, and distributing office. A package is deposited there, directed to some town in the United States, as Haverhill, Mass. From New-York it is then carried with other packets to Boston, to a receiving office there. Here packets are distributed to different parts of the country; and the packet to Haverhill is carried to an office there. If it is a regular periodical publication, the person to whom it is sent knows when to call for it; or, if he has directed a parcel to be transmitted to him, he expects it of course; but, if it is sent to him by a friend, a letter by mail announces the coming package.

Respecting the expediency of establishing such a system of packet waggons, the following remarks may be made.

There is now a great amount of transportation over the country. I have seen it stated that one mail has carried from New-York 3,000 pounds of letters and packets. It has been remarked of the mails from Boston that they are excessively loaded. But the stages do not convey all the periodicals that circulate over the country; for many go by water, and many are distributed by private opportunities. Add together all the literature that is dispersed over the country, critical, scientific, fictitious, classical, and religious—weekly, monthly, quarterly, annual, and occasional—and you have a vast amount of paper to be conveyed.

But it may be further observed that the amount of transportation increases. The lite-

rature of the present day is of a more periodical character than it has been, and periodical publications are many of them of more solid worth than formerly. Books are made cheaper, and they are printed in greater abundance, and the reading population is vastly increased, and there is therefore a much increased transportation of printed paper. The transportation increases also by the influence of great printing establishments. By having a wide circulation for their books, they can print them in great numbers, and by superior presses, and with steam power; and thus they can afford them cheap, and very distant readers are advantageously supplied.

Another fact may be attended to. Transportation by waggons may be much cheaper than by mail stages. It costs four times as much to transport a load at the rate of eight miles an hour, as to transport it at the rate of two miles an hour. Packages might easily be carried 33 miles a day at one-third the expense now attending the conveyance by mail coaches; and for most purposes this would be sufficiently rapid. From New-York, by steam and wind, packages might be carried cheaply and expeditiously to the North and South, to Bangor, Portland, Boston, and New-Haven—to Norfolk, Charleston, and Savannah. From some of these larger depots, lines of conveyance may be established to places of inferior importance, so that every family might find within ten miles, and most families within two or three miles, a place of deposit, where parcels might reach them from distant sections of the Union.

It may again be noticed that the course of trade now requires more transportation. Business is conducted by larger establishments, and the public is benefitted by it. Said Mr. S., a close, calculating farmer, "You may now buy a handsome, iron-hooped, painted pail cheaper than neighbor A. sells one of his clumsy ones." Though neighbor A. loses his business of making pails, the town is on the whole greatly benefitted, and he can turn his hand to some other profitable business; and we can send 100 miles and get our pails cheaper than a cooper at our next door can afford to sell them. This is a specimen of the advantages arising from good means of communication. It was stated not long since in England, that fine goods, parcels of value, and all light articles, which needed to be conveyed with speed and certainty, were sent at great expense by coaches. In many cases light and small articles would be sent by a regular line of conveyance, though more expensive than by the present ordinary routes of trade. The means of communication that now exist have scattered friends and relatives widely from each other, and a regular system of transportation would accommodate them, and be improved by them.

The system recommended now exists to some extent. From one seaport to another bundles are carried by packets, and distributed according to the direction on them; and in some cities, baggage waggons carry goods into the interior towns. This system thus commenced may be made more complete. A deposit store is selected in New-York for Boston or Portland. A packet or steamboat takes the packages left in them, and sends them on in the line with which it is connected, to Boston, Portland, or Bangor, according to their direction. In Boston, if directed to a town near there, they are placed in the deposit store, and the packet waggon that passes to or through that town forwards them; and here they reach their destination; and from the deposit store here they are taken by the person to whom they are sent. I live in the country, about 30 miles from a seaport. I have articles sent me 100 miles by water. The packet master takes these articles to the seaport nearest me, and there the merchant with whom he stores them pays the freight, and the one who brings them up to me pays the freight to the merchant, and I pay the whole cost of transportation to him; both what he paid and what he is to receive for conveying the articles by land.

The establishment of a general system of transportation will help the publishers of books and periodicals, and it will help families.

It will help families. If they wish for a book from their nearest market town, there is a regular line to convey it. If they wish for a book or periodical from a distant city, they can obtain it. They write to the bookseller: he places it in the deposit store, and it is forwarded. Thus families in remote towns have easy access to the literature of the day. If a benevolent society wish to procure a quantity of tracts, or Sabbath school books, they have only to send to a remote establishment, and a bundle is placed in the deposit store, and it goes on to their direction like a letter in the mail.

Such a system of transportation again will help publishers. Postage is one impediment to the circulation of periodicals. It often amounts to one quarter, to one half, or even three quarters the original cost of the periodical. This operates like a heavy duty. Remove this duty, and the circulation of periodicals will be greatly increased, and books in general will be purchased more freely, and printers and booksellers will find increased encouragement.

But to establish such a system a clause in the post office law must be repealed, which enacts "that no person, other than the post-master-general, or his authorized agents, shall set up any foot or horse post, for the conveyance of letters and packets upon any post road which is or may be established as such by law." But if it is seen that the public interest requires the repeal of this clause, Congress can repeal it; and printers, publishers, booksellers, and buyers, can petition for this object.

PUBLICOLA.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum *in advance*.—JOHN WRIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

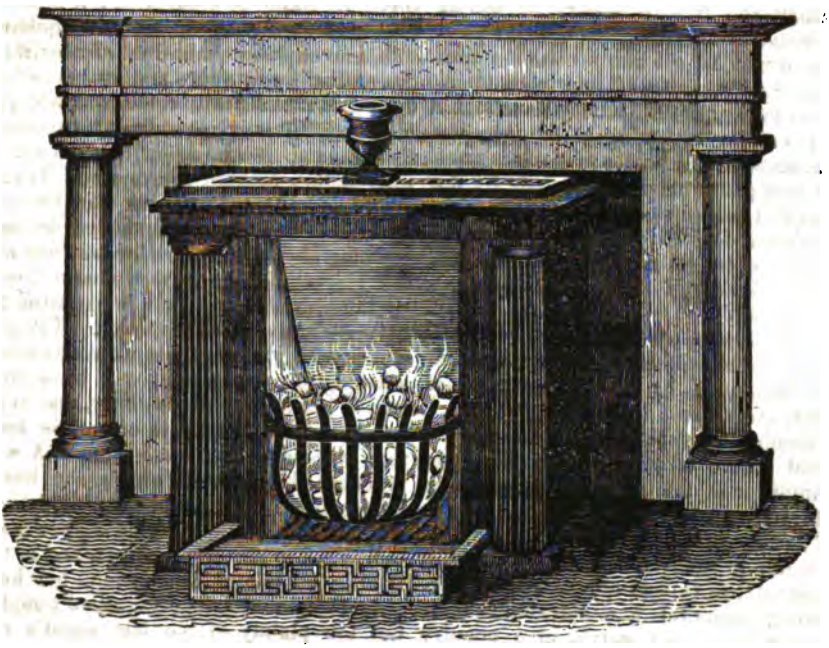
MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING SEPTEMBER 27, 1834. [NUMBER 3.

THE DORIC FIRE-PLACE.



The Doric Fire-Place for burning Anthracite or Bituminous Coal.

We have seen a contrivance for burning anthracite, and indeed any other kind of coal, that should combine the advantages both of an open grate and of a close stove, without subjecting the room to the inconveniences of either. The enormous loss of heat at which coal is burnt in the common open grate has been heartsickening to those of us who have to *pay* for our coal, and to *earn* the money that we pay; for in a common open grate, where a column of air is constantly poured out of the room, up chimney, with nothing to re-place it but fresh cold air pressing through every crack, by door or window, at least three quarters of the heat that is generated by the combustion of the coal is lost to the room; and then, if, in order to avoid this sacrifice of cash and comfort, we have recourse to a close stove, our room may, indeed, be heated, but it is very inadequately ventilated; and while the air is heated, it is also vitiated by the iron plates of the stove, (often raised to a red heat,) over which it passes.

In the Doric Fire-place, the evils, both of the open grate and of the close stove, are avoided, and the chief advantages of both are secured.

We say nothing of the form or style of this article, for in regard to that every one must be allowed to decide according to his own taste. We may however remark, that it has our vote, for it presents a classic front; and if the ladies will look at it with a touching remembrance of all the "toil and trouble" that the brightening up of their brasses now gives them, we are sure we shall have their votes also in favor of the simplicity of the Doric Fire-place.

The following is a statement of its utility:

It secures the safe and *entire* combustion of the coal;

It *saves the heat* produced by that combustion, and converts it to use by diffusing it equally and pleasantly through the room;

It secures the room from *the evil of a smoking chimney*, without recourse to the bad alternative of an open door or window;

It combines, and in itself unites, all the principal advantages of *both the usual modes of communicating heat by radiation*, as in common fire-places, and by *transmission*, as in close stoves—securing the benefits of both without the evils of either. It *warms* while it *ventilates* the room. It is so far *portable* that it can be set into a common fire-place, and again removed from it without injury to the jambs, so that it may be used by a tenant without becoming a fixture. Its construction or arrangement of parts is such that the iron plates are indestructible by the heat, and will therefore *last indefinitely*.

Any person desirous of seeing the Doric Fire-Place can be gratified by calling at No. 1, Chester Buildings, corner of Broadway and Dey street.

Mr. Arnold's Second Report of the Book and Tract Society of the First Congregational Church, New-York.

The pamphlet before us is the second semi-annual record of the proceedings of the public minister of this society. Our author is employed by the society to visit the distressed in any part of the city, and to dispense relief in such instances as he may deem suitable, as well as to administer suitable advice, temporal and spiritual. It is really distressing to observe, in a country abounding with every blessing and luxury that could be wished for, that such scenes of misery and woe should be found as he portrays in the following extracts from his report:

"Would you have a more distinct view of this squalid misery? Go to that cellar up yonder narrow and filthy alley, and look around you. You arrive at the threshold. The room is dark and damp, and noxious vapors and a most offensive odor issue from the opened portal. You involuntarily shrink back with disgust, but, nerving yourself up with firmer resolution, you enter, and what a scene presents itself! A table with three legs leans against the dingy wall, upon which are a few pieces of unwashed and half broken china, surrounded by the fragments of the last miserable meal. A few broken chairs are standing about the room. A bottle and a cup are upon the mantle-piece. A bed of straw, covered with rags, a receptacle for filth and vermin, lies upon a crazy bedstead, or perhaps upon the floor, while the corners and recesses of the room contain the accumulated sweepings of weeks, perhaps of months. Other furniture, if other were ever possessed, has long since gone to the pawnbrokers to furnish the means of debauchery or subsistence; and this remains only because it is absolutely valueless. But this is not all: would to God it were. Upon that bed lies a sick infant. Its head is enlarged and deformed; its eyes are dull; its countenance devoid of expression, save that of misery; its frame is emaciated; it is but half clad, and its disease is the consequence of filth, and exposure, and want of nourishment. Several of its brothers and sisters are already in the churchyard, whither it will probably soon follow, relieved from its present sufferings, and all who know it, even the inhuman mother herself, will rejoice. The other children, with neither hats nor shoes, with unwashed faces, and uncombed heads, are roaming about the streets, or loitering around the markets, or upon the wharves, seeking by importunity, or fraud, wherewith to satisfy the cravings of appetite. The mother stands and gazes at you with astonishment, seeming to wonder what can have brought you to her loathsome dwelling, and hesitates whether to welcome you or not, as hope or fear preponderates in her mind. A word of kindness, however, to which she has been long unused, hastens her decision, and wiping her chair with a tattered apron, she offers you a seat. Her appearance is too revolting for minute description, but her discolored eye, and deeply gashed temple, tell but too plainly of the last night's revelry and succeeding affray. The husband and father is at the ale-house.

"Such are the inmates of this wretched habitation. Such is a description, with some slight variation in the details, of many a miserable and neglected family in this happy land. For them there is no season of prosperity and plenty. Their state is one of continued famine. To them no friend of publicans and sinners proclaims 'glad tidings.' They are outcasts from society; almost abandoned to ruin and desolation, and even excluded from common sympathy. And yet these are human beings—our brethren—the creatures of that God 'who has made of one blood all nations of men, to dwell on all the face of the earth.'"

On the Arrangement of Cylindric Steam Boilers.

To the Editor of the Mechanics' Magazine:

Sir,—It is well known that a cylindric steam boiler, thirty inches in diameter, made

of wrought iron plates one fourth of an inch thick, will sustain a pressure of more than one hundred pounds to the square inch. Of course, a cylinder of the same material, three inches in diameter, will sustain an equal pressure, although the iron of which it is made be but one fortieth of an inch thick; the thickness and strength of the iron being in the same proportion to the diameter as those of the thirty inch cylinder. A thirty inch boiler, eighteen feet long, and presenting one third part of its surface to the action of the fire, will produce about six horse power of steam: from which it may be inferred, that thirty-six cylinders, each being thirty inches long and three inches in diameter, and presenting two thirds of their surface to the action of fire, will also give a six horse power of steam; yet the weight of the thirty-six cylinders may be less than one sixtieth part of that of one large cylinder of the dimensions above specified. Several inventors have endeavored to avail themselves of this principle, but I know of no instance in which they have fairly succeeded in evading the difficulties attending the construction of a boiler consisting of many cylinders or pipes. In one instance, the pipes were so small that they soon became smoked; in another, they were arranged horizontally, consequently the steam could not readily escape; and in both, the pipes have been connected with cross-pipes by brazing, which rendered it difficult to keep them clean from the sediment which always accumulates in boilers; or to remove one without disturbing the arrangement of the rest. With this view of the subject, I have lately constructed a boiler on this principle, which appears likely to be useful for locomotives at least. It produces rather more than one horse power of steam, will sustain a pressure of three hundred pounds to an inch, weighs less than eighty pounds, and cost, (made of copper,) less than sixty dollars; yet so constructed, that the steam rises freely, and that either of the cylinders may be removed occasionally and replaced again in five minutes. The following is the specification of a boiler of the same construction, but of larger dimensions, and calculated for three horse power.

Twenty-four cylinders, made of sheet iron or copper, each being thirteen inches in length, and two and a half inches in diameter, are arranged vertically in two rows, parallel to each other, the cylinders in each row being half an inch apart, and the space between the two rows being eight inches. Each cylinder has a cast metal head at each end, secured by revits, or by brazing; and from the centre of which projects a tube an inch and a half long and one inch in diameter; each tube having ears projecting half an inch from two opposite sides, by which the tubes are secured by screws to the sides of four pipes, which are placed horizontally, parallel to each other, one at the top and another at the bottom of each row of cylinders. These tubes may otherwise be secured to the pipes, by having an iron strap bent over each tube, and a screw passing through each end of each strap into the side of the pipe. One side of each tube is nicely fitted to the side of the pipe to which it is attached; and the pipe and tube having each a corresponding orifice at the point of contact, an internal communication is effected between each cylinder and each pipe connected with each row. These parallel pipes, which are about one inch and a half in diameter, are also connected by cross-pipes at each end. The cross-pipes are cast with a cube at each end, or at the point of connection with the side-pipes; and instead of being open at the ends, have an opening on the side of each cube of a size to admit the end of the side-pipe; and a small iron rod, passing through the length of the side-pipe, and through the cube at each end, has a square head at one end, and a screw and nut at the other, by which the opposite cubes are drawn up to the ends of the pipe. Note—The length and size of the cylinders, the number of cylinders in a row, or the number of rows, may be varied as occasion may require.

The lower part of the cylinders are inclosed in a sheet iron furnace or stove, the height of which is equal to two thirds of that of the cylinders. The top of the stove being fitted to the several rows of cylinders, and the cylinders being filled two thirds full of water, the fire within the stove cannot approach them above the surface of the water. Between the two rows (or each two rows) of cylinders, at the bottom, is a grate, which rests on the bottom pipes; and at the top of the stove a horizontal door, by which the stove is supplied with fuel. Through one side of the stove are several small apertures for the induction of air; and attached to the opposite side is a funnel for the eduction of smoke. Steam-pipes, gauge-cocks, &c. may be attached to either of the pipes or cylinders, as may be most convenient.

I claim as original the arrangement of the cylinders, the method of attaching them to the pipes, and that of connecting the side-pipes with the cross-pipes.

Yours, respectfully,

RUFUS PORTER.

Billerica, Mass., Aug. 22, 1834.

The Mechanics' Institute of the City of New-York.

To the Editor of the Mechanics' Magazine:

Sir,—As the commencement of the annual course of lectures of this Institute is fast approaching, and as I have reason to believe there are still a large number in this city who have little or no idea of the advantages to be derived from being a member of this Institute, in consequence of their not understanding its true character and object, I take the liberty to address to you this communication, with the hope that it may be the means, through the medium of your Magazine, of calling the attention of mechanics in general to the nature, object, and advantages, of the Institute above named.

The grand aim and object of this institution is to place within the reach of the mechanic that scientific knowledge so much required in almost every mechanic art, but which, as yet, is for the most part monopolized by those alone who are capable of sustaining the expense of a college.

The value of scientific knowledge is, perhaps, greater with the mechanic than almost any other person, because it is of constant use to him. In whatever art he may be engaged, the various facts of science are constantly presenting themselves to his view, but, alas! too often are they a dead letter to him. He sees them, and often, too, in their rarest and most interesting forms, but he is only delighted with the phenomena without being instructed; he has never trodden the paths of science, and consequently is incapable of improving, by what he witnesses, either his mind or profession—and thus his ignorance causes him to perpetuate error. Since a knowledge of the physical sciences is of such inestimable value in all the various mechanical pursuits of man, both for their improvement and successful prosecution, and since the improvement of human happiness is in a direct ratio to the progress of man in the acquisition of useful knowledge, it is the duty of every man to grasp all the science within his reach; and it is the duty, and one of the first duties of a Government, to establish such a system of education as will place a knowledge of every useful branch of learning within the reach of *all*. But where do we see such a system? Not in America,

"The land of the free, and the home of the brave."

We have our common schools, true; and alas, nine tenths of those who get any education at all are furnished with an education no better than that of a common school! What is the education of a common school? Is there a syllable of science taught in one, beyond the rudiments of mathematics? No. What then do nine tenths of our population know when their education is finished? Simply to read, write, and practice the rules of common arithmetic! With the view of carrying the mechanic to something beyond the mere knowing how to read, write, and "cipher," the Mechanics' Institute of the City of New-York was established. It was intended as a school for teaching the most useful branches of physical science—to admit the mechanic into the lecture room of the college, and at a charge within the reach of his income.

Among the names most conspicuous in the history of this Institute is that of Professor Steele, of Scotland, who was among the first to propose its establishment. The first course of lectures on Natural Philosophy was delivered by this learned and highly esteemed gentleman, during the winter of 1831–32, with ample apparatus, and in a manner which gave perfect satisfaction. During the winter of 1832–33 the same gentleman delivered a course of forty lectures on Mechanical Philosophy and Chemistry, to which he added, *gratuitously*, a course on Mathematics. During the same season a course was also delivered by another gentleman on Anatomy and Physiology. During the last winter the annual course was delivered by Professor Ellet, of Columbia College.

The lectures are given from twice to three times a week during the winter months, and the advantage to be derived from them, delivered as they are by a professor, with all the requisite apparatus, and the various subjects stripped of the technical language of the schools, and adapted to the most common capacities, is very great, saying nothing of the real pleasure one takes in listening to the lecturer on subjects new and full of wonders. The fatigue of the body from the labors of the past day are forgotten in his attention to the highly pleasing and instructive demonstrations of the lecture room; and when the lecture is finished, he is impatient until the next lecture evening arrives. Besides, the young mechanic is kept from the thousand vices and temptations of a large city like this; and while he is improving his mind, and storing up useful knowledge at the lecture room, he is also contracting a habit of reading and study: for the lecture, when finished, is not neglected. It is a practice recommended by the lecturers, and, I believe, generally practised by the members, especially the younger ones, of reading books on the subjects lectured upon.

and thus, instead of wasting their leisure hours in all those idle vicious pleasures which, while unengaged, they are liable to be led into, their evenings are spent in reading, and in acquiring a respectable acquaintance with those branches of science most necessary in life, most instructive, and most interesting. They obtain for a mere trifle, by a punctual attendance on all the advantages held out by the institution, that valuable information which wealth, as yet, has been able to furnish, and which no institution as yet established, either by State, or General Government, for the diffusion of knowledge among the indigent, furnishes.

That the reader may obtain a better idea of this institution than the above remarks may furnish, I will here give its constitution entire.

CONSTITUTION.

Section I. Art. 1. This Society shall be denominated THE MECHANICS' INSTITUTE OF THE CITY OF NEW-YORK.

Art. 2. Its object shall be the instruction of Mechanics and others in popular and useful science, and its application to the Arts and Manufactures, by means of lectures, apparatus, models of machinery, a museum, and a library.

Section II. Art. 1. This Society shall consist of an unlimited number of members, who shall be divided into two classes, namely, regular and life members.

Art. 2. Any person paying *twenty-five dollars* may become a life member, provided he is recommended and chosen in the same way as regular members, and such life members shall not be called upon for any annual payments.

Section III. Art. 1. The officers of this Institute shall be a President, two Vice Presidents, a Recording Secretary, a Corresponding Secretary, a Treasurer, and twelve Directors, to be elected annually by ballot—the persons having a majority of votes shall be declared duly elected; provided, however, that no member whose dues shall remain unpaid for more than twelve months, (unless he shall have been exempted from payment by a vote of the Society,) shall be allowed to vote at any such elections.

Art. 2. The President, Vice President, Secretary, Treasurer, and Directors, shall constitute a Board of Directors, with full powers to appropriate funds, (under the direction of the Society,) and generally to conduct the affairs of the Institute. Not less than two thirds of this Board must be operative mechanics.

Art. 3. The Recording Secretary shall engross in a book, to be kept for that purpose, the minutes of all the transactions of the Society, the names of the members, of donors, and all other matters requiring to be recorded. He shall also receive all dues and donations in money, and pay the same over to the Treasurer, and take his receipt for the same; and shall also make out a report quarterly, and exhibit it to the Society; and post up the names of all persons proposed as members in the place designated for that purpose.

Art. 4. The Treasurer shall receive all dues and donations in money from the Secretary, and give a receipt therefor; pay all drafts on him when signed by the Secretary and countersigned by the President; keep a regular account of the financial concerns of the Institute, an abstract of which, accompanied with satisfactory vouchers, he shall exhibit quarterly, and at such other times as shall be required.

Section IV. Art. 1. Every person on becoming a member shall subscribe this Constitution and pay the sum of *two dollars*; and every member shall be subject to an annual payment of *two dollars*, which shall be paid on the first meeting in October, or before a member receives his ticket of admission to the lectures.

Art. 2. The initiation fee may be increased in proportion to the increased value of the property belonging to the Institute; but this cannot be done except by a resolution passed at a general meeting.

Art. 3. The Institute will gratefully receive donations of money, books, apparatus, models of machinery, drawings, or natural and artificial curiosities, which donations, together with the names of the donors, shall be registered in the books of the Society kept for that purpose.

Section V. Art. 1. An annual general meeting of this Society shall be held on the second Monday evening of April, to audit accounts, elect officers, and transact other business connected with the Society.

Art. 2. The annual tickets of regular and life members may be transferred; but persons to whom they are transferred shall not be admissible to any office or vote; the management of the Institute being invested in the regular and life members, who are eligible to any office, and entitled to vote on all questions connected with the Institute.

Art. 3. In order to preserve the harmony of the Society, nothing of a religious, irreligious, or political tendency shall be admissible, on any account, at any meeting of the Institute.

Art. 4. In order to make the Institution as generally useful as possible, any person shall be entitled to the privilege of reading from the library and attending the lectures, or any other course of instruction that may be given in the Institution, for one year, on paying such a sum as the Society shall determine; but such person shall not be entitled to any share in the management of the Society, can be eligible to no office, nor entitled to vote on any question whatever.

Art. 5. This Society shall be permanent, and its property unalienable, but each member shall possess the power to transfer his share, provided the person to whom he transfers is approved of by the Society in the same manner as admitting new members.

Art. 6. Any proposal to alter or amend this Constitution must be made in writing, and subscribed by at least ten members: it must be delivered to the Secretary, who shall read it at the first regular meeting, after which it shall lie over for discussion, and the proposed amendment finally adopted or rejected by a majority of the members present, the votes being taken by ballot.

For further information to those who may wish to become members of the Institute, I add the following from its by-laws:

MEMBERS.

Sec. 1. Persons wishing to become members must be proposed at least one meeting previous to being balloted for; and all candidates having a majority of the votes of the members present, shall be declared duly elected.

Sec. 2. Every member on payment of the initiation fee shall receive a card, which he shall produce, if required, as proof of membership; but no member shall be entitled to the privileges of the Institute whose dues shall be in arrears.

Sec. 3. The Institute may expel any member,

whose dues, &c. have remained in arrears for a longer period than one year.

Attached to the Institute is a small but well selected library, and a reading room, furnished with books, newspapers, periodicals, &c. &c. all of which are free to the members. The *sole* expense of each member, after paying the initiation fee, is *two dollars* each year, a sum so exceedingly moderate as to prevent no one from being a member. The present number of members is between four and five hundred.

This institution, as an instrument for the promotion of virtue, for diffusing throughout society those principles of morality which are the foundation of universal concord, of public as well as of private peace, unanimity, and happiness, deserves the particular regard of every lover of liberty, every true patriot, and every genuine philanthropist. Virtue is a general consequence of knowledge, and vice the absence of it; and, therefore, every institution for the diffusion of the one operates as a check to the other. The establishment and success of such an institution is an unequivocal and encouraging sign of the times—it shows that the advantages of knowledge are seen and deeply felt, and that too by the most useful and numerous class of citizens. It shows that a degree of energy, which will overcome all the obstacles to a participation in the pleasures and advantages of science, exists in that part of our population to whom science is of the most importance, but who have the least of it, and who, for any thing we see in the present state of things, must continue to have the least of it, unless they combine their efforts, and thus obtain that which legislative power as yet denies them.

Your obedient servant, A.

[We cordially agree with our esteemed correspondent as it regards the utility of the "New-York Mechanics' Institute," *even as at present conducted*. We have been long of opinion that there is not sufficient of popular science introduced by the lecturers and managers of that institution, and they would do well to bear in mind, that there are other modes of instruction than lectures. We wish they would follow the example of the "London Mechanics' Institution," and establish classes for self-instruction in the various sciences; that course has been of great benefit to many of the members of that institution. Nor do they confine themselves to science: they have classes for learning the French, Italian, Spanish, and other languages, &c. &c. We throw out these hints with every good feeling towards the success of the society.—Ed. M. M.]

On the Comparative Value and Importance of Mathematical Science, and on the Pretensions of its Professors.

[From the London Mechanics' Magazine.]

Sir,—Whilst occupied in writing a reply to Kinclaven, I was led to indulge in some observations on the intellectual grade and practical value which ought to be assigned to mathematical acquirements, and on the overweening pretensions of some of the mathematicians; but these remarks became so much extended under my hand, that I have thought it best to give them to you under another form.

I am sir, yours respectfully,

Benj. Cheverton.

Men's minds appear to be differently constituted in regard to the investigation of things. Whilst the generality take a view of a subject merely as a particular case, and reason upon and examine it only as connected with its more immediate causes and consequences, the profound inquirer analyses it, to discover the law or principle which pervades it in common with many others; to trace and connect it with those of dissimilar aspect; to show that in the abstract they belong to one common truth, though in the concrete, or in their actual existence, produced by the modifying agencies of their peculiar circumstances, they present appearances which apparently have no relation to each other. Such are the minds who have for their high aim the extension of the principles of knowledge; but though peculiarly fitted for discovery, they are not the best qualified to bring science down to practical application, or even to make it literally accord with matter of fact. In disentangling the complications resulting from concomitant agencies, they are so intent on arriving at the most general truths, so systematically disregardful of the separate consideration of those agencies, and so much in the habit of keeping the analysis disencumbered of all ideas not comprised in the upward leading train, that when, by a course of synthetical reasoning, they would turn their discovered principles to account, and build up a system on their foundation, they too much exclude the operation of the subordinate laws which concur in influencing, and more immediately regulate, the ultimate result, and which give to things the form and appearance which they present. Their conclusions, though correctly drawn, are true only in part, and by assumption and limitation, true mentally, but not materially, or as found in actual existence.

But there is another class of minds of

nearly the same stamp and mould as the former, who, though not taking the like grand and original views, are yet of a kindred spirit. The former act the part of pioneers, but these take to the circumstantials, and bring into subjection what the others merely pass by. They fill up that outline of a science or system which the former, in the discovery of its most general law, was content merely to trace; they bring the analysis to bear on all the relations implicated; weigh, balance, and proportion the conflicting agencies; and are thus enabled to perfect the subsequent synthesis in all its details, to take a complete view of the subject in all its parts, and a comprehensive one in all its bearings, and to bring forth to view the modified results, the exceptions and the anomalies, as illustrations of, and confirming attestations to, the fraudulent truths which at first sight they may appear to invalidate.

Both these classes of men are philosophers, the distinction between them having reference to a tendency to generalize, rather than to the usefulness of their labors, or the rank in which they ought to stand; but they *may not* be mathematicians, that depending on the circumstance whether the science of quantity is required in their investigations. These last, therefore, form a third class, whose object is less the extension and perfection of science or system, than the cultivation of the means thereof, so far as the relations of quantity are concerned.

The mathematicians—I mean mere mathematicians—are doubtless valuable members of the body scientific, but some among them, (the least generally informed,) are sadly inclined to over-estimate the honor of their station, and the comparative value and importance of their labors. In the great field of science, to say nothing of the greater field of knowledge, they occupy merely one of its sections, they facilitate and abridge the work of some, and co-operate in the work of others; but they are neither the pioneers nor the finishers of the operations going on around. Subsidiary and assistant to original investigation, the *science of quantity* is of important service, but if put forward and esteemed as the *science of things*, it is worse than useless, and many who might have made good philosophers, have been spoiled by the false glare reflected from their own doings being taken for the true light thrown on Nature's works. The lines and characters with which mathematical operations are conducted, and whose results, though only abstractions, are too often confounded and identified with realities, are not only the mere symbols of things, but the symbols merely of one or two qualities in things; and therefore, though the conclusions are true, rigorously true, as to the signs, they are false as to the things themselves, when regarded in their ultimate modified results, from the influence of those qualities or accidents which the mathematician does not or cannot symbolise—which he does not, because the complication arising from their reciprocal actions exceeds and defies his means—which he cannot, because in regard to some of them there is not sufficient analogy in the types to warrant the deductions they afford being transferred to the archetypes. Even as to those said qualities (extension and individuality) which form the subject matter of mathematics, the investigation is often limited, and therefore imperfect, from the impossibility of extending the analysis to all the ramifications which branch forth from it. The mathematician arrives at the truth, and nothing but the truth, but not at the whole truth—not even at the whole of the only kind of truth which symbols give. When, however, the case is so simple that the investigation comprehends all the possible relations belonging to those qualities, and the only result sought for in things is a knowledge of those relations, then it may be said, and only then, that the conclusions of the science are not only indubitable, but identical with realities—but what does not this limitation exclude?

The mathematician has a little, a very little, world of his own, in which every thing is in the utmost order, subject to known laws, involving definite and foreseen action, liable to no interference not calculated on and provided for, and the whole capable of coming within his own powers to regulate and govern according to assigned rules; for things which cannot be made amenable to his jurisdiction are ejected from his dominion. He therefore admits nothing of unknown power, or which may exert an influence which he cannot see, and introduce uncertainty and casualty within his precincts. Hence, also, many agencies, though well understood, are rejected by him, lest they should prove too numerous for his perfect cognisance, and lest more subordinate laws should obtain than he can see and understand their bearings; or else he accepts only the first modifications which they may produce, and then casts them out altogether, whereby he avoids the many puzzling anomalies and exceptions which would proceed from their mutual actions. Hence, also, he ejects, as they arise, whatever among the collateral effects may complicate and embarrass the more direct train of results. Thus he sees and compre-

hends every thing, the whole is within his grasp, demonstration attends him at every step, aberrations are impossible, contingencies are out of the question, all results are naked to his sight, and his prescience embraces all, because his knowledge is certain and perfect, and extends to all. But, on the other hand, this is a world of curtailment and exclusion, in which nature is deprived of her just proportions, and of many of her endowments—it is a world of meagre forms and distorted shapes; and thus feeble man, failing to stretch his powers to a comprehension of the full length and breadth and depth of things, makes the things themselves conform to the extent of his own puny faculties, and then, in all the self-sufficiency of pride, exclaims—behold! this is nature![*]

When the mathematician comes forth from this tiny world of his into the world of realities, he is bewildered with the multiplicity of its objects, he is confounded with the immensity of their relations and mutual aspects. He looks for certainty, and can scarcely find probability. Accustomed to demonstrate, he is unqualified to estimate; and in the habit of concentrating his attention to a single, unbroken, unerring, and necessary chain of inferences, and having the power permanently to record its every link, and fix the otherwise fleeting convictions of certainty, he is unfitted to retain a steady and expansive view of several collateral lines of action, to balance conflicting influences, to adjust their proportions, and from the whole to educe the nearest to the true conclusion which only actual results can make to appear. Emerging from his world of abstract ideas, if indeed it be so much as this, he finds the real world, and the things thereof, to be a perfect enigma. He can follow, it may be, in the track of those who have unravelled it a little; but he has no powers of himself to unravel it further. Desirous, however, of doing something, though it may be only after his own method, suiting, therefore, the subject to his means and habits, he seizes a few of the most manageable facts; and if they are not to him already isolated, by his ignorance of the ties by which they with all things are bound together, he takes care to sever their connection with disturbing causes, and to rid himself of all embarrassing extraneous influences. If his facts are not sufficiently fruitful of principles, he can eke out his case with a few postulates; and if they are untractable, he can frame an hypothesis which shall present as nearly as possible the same appearances. He then proceeds in the most lucid and masterly manner, to build his system scientifically. All its parts are in harmony, all its conclusions are demonstrable. His penchant for clearness, order, and certainty, is gratified, and he fondly flatters himself that the results which he brings forth are conformable to nature. He does not consider that the harmony and clearness which he so much admires, gives every reason to suspect that he is entirely wrong; for the one may arise from every element of discord being rejected, and the other from those narrow and contracted views, which, by reason of our limited faculties, we are only able to take when absolute certainty is to be the result. Professor Sedgwick, whose scientific pursuits tend to enlarge and expand the mind, has a just observation in a recent publication of his, which, though having an immediate application to one particular subject, is by no means foreign to the tenor of the present remarks: "To suppose that we can reason up to a First Cause in moral questions—that we can reach some simple principle, whence we can descend with logical precision to all the complicated duties of a social being, is to misapprehend the nature of our faculties, and utterly mistake the relation we bear both to God and man. Such a system may delight by its clearness, and flatter our pride, because it appears to bring all our duties within our narrow grasp; *but it is clear only because it is shallow, while a better system may seem darker only because it is more profound.*" Thus, the mere mathematician is disqualified by his prejudices, his habits, and the tutored bias of his mind, to look at the world of nature as it is. For, however paradoxical it may appear, views may be taken of it, which, though less exact than his, may be more complete, and though less certain, may be more probable. He is really better qualified to comprehend an entire system of worlds, so far as it may be explored by others possessed of a superior order of intellectual gifts—for the only point of view in which he can regard them, is merely as individual entities, whose dependence on each other is governed by one universal law of influence, and whose aberrations and disturbances, therefore, are not in the main beyond his scope. But in respect to mundane affairs, he has not the *coup d'œil*, the tact, or the *intuitive* perception, as it appears to be—though it is not that, nor is it innate, except so far as natural aptitude is concerned; but it is a deliberate process, and an acquire-

[*] The arrogance of some of the naturalists is astonishing. They sit in judgment on nature, criticise her works, and talk of the attempts in which she has failed to perfect her plan. After all that has been said of the inductive philosophy, and of our being the humble disciples of nature, the race of the king of Castile is not yet extinct.

ment derived from long habituated reaches of comprehensive thought, and faculties well disciplined by suitable practice—he has not, I say, that fine *eventual* perception, as it may with more propriety be called, which includes the whole implication of things, their mutual actions, and their final issue, whereby others are enabled to combine vastly, if not minutely, to establish something like order and gradation in the gross, if not in the detail; to foresee with a degree of certainty, though it may be with some obscurity; and to catch the shadows, if not the lineaments, of unknown forms. Such powers in any perfection are not often combined with high mathematical attributes, for they are of diverse tendency; but when they are united and directed with a combined effort to connect systematically the wide survey with first principles, they mark not only the true but the pre-eminent philosopher. Such was Newton. In his profound inquiries into the phenomena of nature, requiring new methods of mathematical investigation, his merits in that respect are, no doubt, eminently conspicuous; but yet, as the founder of a system, it is not so much the mathematician as the philosopher which shines forth in him. What a contrast there is between him and Descartes. With what sagacity he brought to light slight and hidden analogies, and what wisdom is displayed even in his scholia and his queries. His very conjectures partake of the nature of science. How extraordinary was that concerning the diamond; and who can say that his idea concerning the cause of gravitation may not yet be verified, or at least rendered highly probable?

The tendency of mathematical studies to unfit the mathematician for the general study of nature, and for investigation into the complex structure of human affairs, has now been stated—in very general terms confessedly, but that of course was unavoidable, unless there was an intention to write a complete dissertation on the subject. There is, however, another cause which lies at the root of that unfitness, peculiar to the mere mathematician. It consists in the very structure of the mind, that is, in the inequality of his faculties. "In almost all the instances of mental superiority," says Dr. Chalmers, "it will be found that it is a superiority above the average level of the species in but one thing—or that arises from the predominance of one faculty over all the rest." We may extend this remark, and say that nature is seldom perfect in opposite directions in the same individual, and that if her bounty flows strongly in any particular channel, it is generally at the *expense* of the diverging streams. This is so remarkably the case in regard to the mathematician, that deficiency in judgment is proverbially ascribed to him. Now judgment, in a popular sense, is a collective word for the several faculties which concern not the abstract ideas, but the realities of things in their actual forms. Thus both the congenital deficiency and the predisposition mutually concur with the habit which they produce to make the mere mathematician what he is—utterly unqualified to investigate any thing out of his own province. But properly to establish the point of his *natural* inaptitude would lead me too far into metaphysical, and, as some would think, into phrenological disquisitions.

Nature may, in some instances, bestow her gifts with as balanced as a bounteous hand; but then the study of mathematics, in all its fullness, is so engrossing, demanding so large a portion of time, as to preclude the generality of its students from the acquirement of that extensive knowledge of things and their relations which is necessary to furnish the philosophic mind. "Mathematics," says Duncan in his Logic, "is an engaging study; and men who apply themselves that way so wholly plunge into it, that they are, for the most part, but little acquainted with other branches of knowledge. Even such as are alleged to have excelled in their own profession, and to have discovered themselves perfect masters of the art of reasoning, have not always been happy in treating upon other subjects; but rather fallen short, not only of what might naturally have been expected from them, but of many writers much less exercised in the rules of argumentation. Because, however perfect they may be in the art of reasoning, yet wanting here those intermediate ideas, which are necessary to furnish out a due train of propositions, all their skill and ability fails them, for a bare knowledge of the rules are not sufficient—we must further have materials whereunto to apply them."

Barbeyrac, in the preface to his translation of Grotius, "De Jure Belli et Pacis," informs us, says Kirwan, that a mathematician undertook to refute it; but of this refutation he says, "on n'a jamais rien vu de plus pitoyable, et on seroit surpris qu'un mathematicien put si mal raisonner, si l'on n'avoit d'autres exemples bien plus illustres, qui montrent clairment que l'etude des mathematiques, ne rend pas toujours l'esprit plus juste en matiere des choses qui sont hors de la sphere de ces sciences." And Condillac, according to the same author,

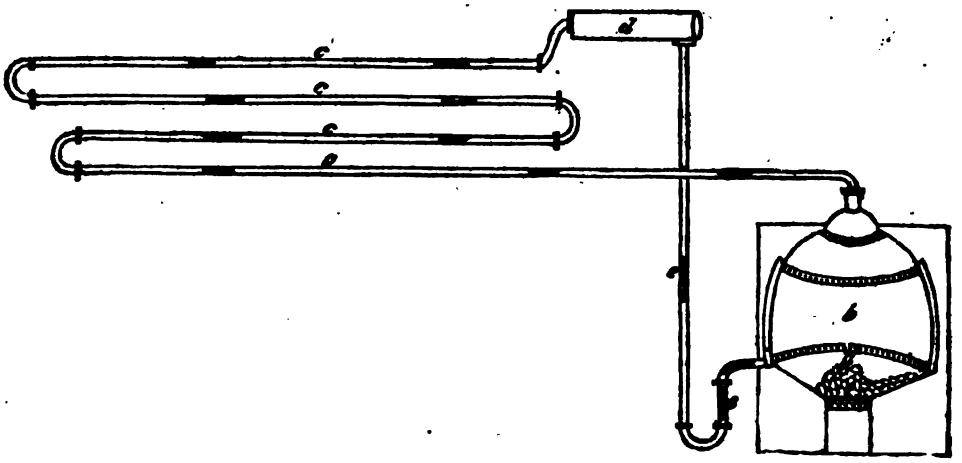
says, "nous avons quatre metaphysiciens celebres, Descartes, Malbranche, Leibnitz, et Locke; le dernier et le seul qui ne fut pas geometre, et de combien n'est il pas superieur aux trois autres?"

It cannot, however, be denied that a few mathematicians have been philosophers; or, rather, that some philosophers have also been mathematicians. Men possessed of an equilibrium of the faculties, and endowed with sufficient energy to sustain and invigorate them all—men of panoramic as well as of microscopic vision—men who extend their views beyond the mere rules, the elegant abridgments, and the ingenious artifices of the science, and who, valuing them only as means to a nobler end, merge the powers of the analyst in subservience to the grand objects of philosophy. It is from men like these that the mere mathematician has received a reflected lustre, and a consideration which is not his due. But the far greater number of philosophers, and the most useful ones too, have *not* been mathematicians. To instance only in our own time, and without adverting to living characters—having regard only to one branch of physical science, that which concerns the intimate nature and constitution of bodies, and passing by the various other departments of philosophy, such as morals, economics, physiology, geology, and the like, we may mention the names of Priestley, Franklin, Davy, and Wollaston.* It is probable that most of our eminent philosophers may have had some slight general knowledge of the mathematics, such as even our practical men commonly possess, and such as becomes a liberal education. They may have run through Euclid just as they may have run through Homer; nay, they may have done more than this, without being mathematicians any more than they were Grecians. This, in particular, may be said of the last-mentioned philosopher, though I believe so much even cannot be affirmed of the others. Even among our engineers, whose pursuits would seem to make mathematical acquirements more requisite, the most eminent, such as Smeaton, Watt, Rennie, and Telford, have not been distinguished by any beyond the merest common-place. Many of their compeers have advanced much farther in these routine attainments, and yet wanted that tact, that fine superior sense, which is far more indispensable to the man who has to take and deal with things as they are, enveloped in all their circumstances, and subject to all their qualities and contingencies. Sir John Herschell observes, that "almost all the great combinations of modern mechanism, and many of its refinements, are *creations of pure intellect*, grounding its exertions upon a very *moderate number of elementary propositions* in theoretical mechanics and geometry." In what have the pupils of the *Ecole Polytechnique*, who are all mathematicians, excelled our own engineers? Let the fate of the first suspension-bridge at Paris tell. We have yet to avail ourselves of the eminent services which the high mathematical attainments of the pupils of our own school of naval architecture were to render to the science—if science yet it be. What has been the result? Does even the Surveyor of the Navy put forward any scientific pretensions? Has he not been selected out of another profession? Has the professor of the school himself succeeded better, or so well, as the unpretending shipwright who built the Pearl? Let it not, however, be understood, that the school has not sent forth able and useful men, or that they have received rewards equivalent to their merits. But it is maintained that in this, as in many other cases, the tentative method has been, and perhaps ever will be, of more value than science, and that those qualities of the mind for which I have contended, and which science cannot give, are superior to and more indispensable than mathematical attainments; and this may be said without condemning the application of analysis, as far as may be, to the successful results which experiments on a large scale may have produced. In such analysis, indeed, if sagaciously and not too rigidly and scientifically conducted, those superior qualities will appear, just as they do appear, in the rough empirical sort of analysis which the successful though unpretending shipwright calls to his aid. Those among the students who are in possession of these natural gifts, will break through the prejudices and pedantry which a too engrossing attention to mere science creates, and keeping it in its proper place will make it secondary or subservient to a comprehensive view of their peculiar and very complicated subject, satisfied, if they cannot mark and estimate all the concomitant influences, in a manner so precise and determinate as they could wish, that they at least form their conceptions and draw their conclusions in conformity to the *truth* of things.†

(*To be continued.*)

* We have Mr. Babbage's authority in regard to Dr Wollaston.

† Let this be exemplified by an able article which appeared within these few months in the "United Service Journal," written, I believe, by a pupil of the school above mentioned.



Notice of a Hot-Water Apparatus, invented by Mr. John Darkin, Engineer, Norwich.

Having observed a paragraph respecting this apparatus in a Norwich newspaper, we wrote to Mr. Darkin, who, with commendable liberality and promptitude, sent us the annexed letter and sketch. The system adopted appears to be similar to that of Mr. Perkins, but at a temperature not exceeding that of boiling water.

"In reply to your inquiry, I cannot tell whether my hot water apparatus differs from all others in use or not, never having seen a single design of the kind until after I had constructed my own; and since that time I have only read the accounts of those which are described in the Gardener's Magazine. I have derived much amusement from these, from observing that other attempts have been attended with similar difficulties to those which I had to encounter, before I could get this apparatus to act to my wishes. I have great pleasure in sending you a description of it, in order that you may judge of its merits; and if you think it likely to afford additional hints, and to be deserving of a place in either the Gardener's Magazine, or in the Architectural Magazine, it is very much at your service.

"The apparatus consists of a furnace, a boiler, cast-iron tubes of any diameter, an expansion tube, &c. as shown in the accompanying sketch. The tubes may be connected with the boiler, in any way which circumstances require, and carried in any direction, so that they do not descend below the level of the bottom of the boiler. It being understood that a given number of superficial feet of tube will throw off a certain quantity of cubic feet of hot air per minute, it can easily be ascertained by the admeasurement of the house, and the quantity of glass in it, what quantity of tubing is required for it.

"I need not enlarge upon the efficiency and economy of my own plan of warming, as you will be a competent judge of its qualities by my description of it. It certainly has a decided superiority, in every respect, over the common mode of heating by flues, and particularly in retaining *the required temperature* with a small consumption of fuel, and very trifling attention. Boiling water is much to be preferred to steam heat. My own green-house, in which the apparatus is constructed, loses but a few degrees of heat by allowing the fire to go out for six or eight hours in the night. A short time is sufficient to make the water boil again, when it expands and displaces the cold water in the tubes, which are immediately supplied with hot water from the boiler, the cold water retiring through the expansion tube down the returning tube, whence it is heated and again projected forward; thus keeping up a continued circulation of hot water through the tubes for a considerable time, even after the fire has been allowed to die out.

"This apparatus can be applied with the best effect to horticultural and public buildings of every description, mansions, offices, warehouses, drying rooms, &c. &c.; and, as the tubes have no connection with the fire, not a particle of burned air is communicated by them to the room in which they act."—[Loudon's Magazine.]

Mr. Russell's Steam Carriages.

[From the Edinburgh Observer.]

Through the medium of a letter received from Glasgow, we are happy to record the great and increasing success of these car-

riages. Our friend writes, that having recommenced their regular business-career on Wednesday morning, they ran throughout the day with the utmost punctuality. The rate of speed may be judged of from the following statement sent us: 1st carriage, No. 4, 30 minutes; 2d, No. 4, 34 do.; 3d, No. 3, 45 do.; 4th, No. 3, 46 do.; 5th, No. 1, 25 do.; 6th, No. 1, 25 do. The distance here taken is from Tradeston, Glasgow, to the Tontine Inn, Paisley; for although the carriages start from George's square, they are of course not put to their speed until they have got clear of the crowded streets; but as this distance is at least seven miles, the rate attained by the last mentioned vehicle, which we understand is the one containing the most recent improvements, is not much less than 17 miles per hour. Another circumstance, we are glad to hear, was that so highly have the public in that quarter already begun to appreciate this new mode of conveyance, that the carriages were overloaded with passengers the whole day. We observe, however, that the trustees of the Glasgow and Paisley road are by no means favorable to the undertaking, and have been for this week past busying themselves in laying down immense heaps of stones on all the ascents and *best* portions of the road, for the apparent purpose of obstructing the progress of the carriages, though hitherto without effect. This conduct, as might have been expected, is meeting with the general indignation of the people in that quarter.

[From the Glasgow Courier of July 1.]

We have much pleasure in noticing the last two days' most successful performance of the Glasgow and Paisley steam carriages. On Wednesday the carriages performed six trips, running every hour from ten till three o'clock, and yesterday an equal number. The carriages were crowded with passengers, and so great was the anxiety to obtain seats, that although there is accommodation for twenty-six, it was found impossible to prevent upwards of thirty persons from taking seats upon them. The average velocity of the carriage is twelve miles an hour, and the only impediment to a high rate lies in the extraordinary state of the road, which should at this moment be in the best possible condition, but has just been deeply bedded with broken stones, laid on in large masses, for the purpose of injuring the carriages. This is a line of illiberal policy, which it is hoped the trustees will not persevere in, as it cannot possibly in any way affect the success of the carriages, which will assuredly be carried through with advantage, while the road is thereby rendered unfit for the purposes of general traffic, at a great expense to a public trust. At the sixth trip upon Wednesday last, and as the steam carriage was coming up to the new metal, it was found that enormous heaps of stone had just been laid down; and the tremendous power requisite to bear through it smashed one of the wheels, and detained the carriage till it was replaced.

[From the Glasgow Herald.]

On the evening of Friday last, a highly interesting experiment was made upon the Paisley road for the purpose of ascertaining the comparative merits of two of the company's carriages upon different constructions. A little after six o'clock the carriages left George's square, with a full supply of fuel and water adequate for eight miles. The carriages proceeded together through the crowded streets, as rapidly as safety would admit, and along the Paisley road to a point a little beyond the two-mile house, where they turned and started together. After keeping exactly together for about a quarter of a mile, the carriage on the improved construction began to show a manifest superiority, and rapidly distanced the other; and on arriving at the Gorbals, Glasgow, had gained half a mile, having done the whole distance in seven and a half minutes, while the latter required ten minutes. The same carriage had, on the previous Wednesday, done the distance from the Tontine at Paisley to the Gorbals of Glasgow, being seven miles, in thirty-three minutes, including stoppages.

[From the Glasgow Courier of July 4.]

On Wednesday the steam carriages commenced running every hour, with passengers and luggage; and they have since been plying with the most triumphant success. The carriages start from George's square a little before the hour, and proceeding down Queen street, take up passengers at the foot of it, and starting from the head of Maxwell street they pass through Tradeston, where they again take up passengers. This generally occupies about twelve or fifteen minutes; and the seven miles to Paisley are then done in thirty or thirty-five minutes. A few minutes are thus left to take in a supply of water and fuel, with the complement of passengers, at Paisley; and at the succeeding hour the same carriage again returns to Glasgow.

We also noticed in our publication of Tuesday the *kindness* with which the road trustees, at the Glasgow end, has accommodated Mr. Russell's carriages at their own expense (or that of the public), with a suffi-

cient quantity of new metal, to try their powers; but we have since discovered that this *kindly disposition* has been carried a little too far, and that having found the carriages more than competent to the task of ploughing through the stratum of broken stones, previously laid down, they employed a large number of men on the following day, to lay down another stratum of equal thickness on the top of the former, rendering the road scarcely passable to any heavy load. Finding this expedient also ineffectual, we learnt yesterday that horses and carts and a number of men had been engaged during the whole of the night in laying down loads of broken stones, to such a depth that they were obliged to cut away the bottom of the toll-gate in order to allow it to close over the mass.

The difficulties surmounted in bringing these vehicles to the perfection here indicated, and the qualifications of the inventor, are what scientific persons alone can duly appreciate; and we certainly cannot furnish our readers with a more striking estimate of both than by quoting the following observations from a very able paper on "the relation between a machine and its model," by Mr. Edward Sang, teacher of mathematics in Edinburgh, and which we find in the Mechanics' Magazine for January last:

"At the surface of Jupiter, a steamboat of 20 horses power would be unable to move —at the surface of our earth, one of perhaps 1000 horses power might perform pretty well; but at the surface of the moon, they might be made of perhaps 20,000 horses power—supposing the pressures of the atmospheres in the three cases to be alike. On Jupiter, a steam carriage would be an absolute chimera; *on the earth, it is barely possible;* but on the moon, nothing would be more usual. An intensity of gravitation, slightly greater than that which the earth exerts, would altogether preclude the hope of obtaining a locomotive engine. As it is, on flat railroads they perform well; as the road becomes inclined, they become less practicable; *and on common roads, nothing but the most consummate skill in the selection and in the use of the material, as well as in the contrivance of the parts, can ever be successful in their construction.* Security demands strength, strength requires weight, weight increases the friction, friction calls for additional power, and power can be procured only by an increase of weight. *To reconcile these conflicting claims is not the task for a beginner in mechanical contrivance, but for one well versed alike in the theory and in the practice of the arts.*"

TUNNEL UNDER THE OHIO.—A writer in the Cincinnati Journal recommends the construction of a railroad under the Ohio river, opposite that city. The following is an outline of the plan:

The railway is to consist of two semi-ellipses, one above and the other underneath. The height of the upper arch to be 10 feet, and the lower 3 feet, and 24 feet in width inside, making the ellipse 13 feet high and 24 feet wide in the clear. The arch to be composed of cut stone masonry two feet thick. This arch is to be buried in the ground just sufficient to protect it from the action of the river. A floor composed of timbers laid lengthwise, on the bottom of the arch, and covered with planks, forms the carriage-ways and side-walks. The carriage-ways to be each 8 feet wide, and the side-walks each 4 feet wide. The side-walks are a little raised above the carriage-ways. The stones composing the arch are to be cut so as to form segments of the ellipses, and laid in hydraulic cement, and made as near water-tight as practicable. Notwithstanding all the care that may be taken in the construction, yet with a pressure, in time of high water, of 4375 pounds upon each square foot of the arch, the water will percolate through in such quantities as to require an engine to keep the road dry. It will of course be necessary to light the interior when opened for travel.

Between high and low water marks, there is a difference at this place of about 68 feet, and allowing the top of the arch to be 7 feet below low water in the bed of the river, and placing the bottom of the arch at each end, at high water mark, will make the total descent 83 feet. It is thought that one foot ascent in twelve feet horizontal distance is the greatest inclination the road will admit; consequently, the length of the inclined arch, from high water mark to the bed of the river, will be about 1000 feet; and allowing also that the bed of the river at low water is about 1000 feet wide, will make the total length of the road 3000 feet.

The only difficult point in executing the work will be in excavating the earth and rock below low water. It is quite practicable, however, in a dry season, at comparatively small expense, to enclose a space with a frame of timber and plank, made water-tight by placing bags of earth around the outside, and pump out the water with an engine placed upon a flat boat, until the excavation is completed and the arch formed within the space enclosed. Then by moving the same coffer-dam its length farther along, another space can be enclosed, and the work com-

pleted in the same manner, and repeated until the bed of the river is crossed. This part of the work will depend upon so many contingencies that no accurate estimate can be made of the expense attending it. The masonry of the arch and the flooring can be estimated with tolerable accuracy. The stone for the work can be obtained one hundred miles up the river, where extensive quarries are already opened. The cost of the masonry will be as follows:

Quarrying the stone per perch of 16½ cubic feet	...	$1 00
Delivering do. do.	do.	2 50
Cutting the same with three faces,	do.	2 25
Mortar of water, lime, and sand,	do.	50
Laying the stone, including centering,	do.	75
Cost per perch,.....		$7 00
Every 10 feet in length of the arch will contain 78 perches of masonry, which, at $7 per perch, will be.....		$546 00
Every 10 feet in length of the floor will contain 100 feet of timber, at 12½ cents per foot, $12 50 —220 feet of plank at 3½ cents, $7 70.....		20 20
Total cost of 10 feet of the road-way.....		$566 20

Which being multiplied by 300, for the length, will give $169,860 for the total cost of the arch and flooring. If to the above we add the probable cost of pumping the water and excavating the earth and rock for the road-way, and of covering the arch over again 3 feet deep, it will make the total expense not less than $210,000. To which should be added $20,000 for superintendence and expenses of the affairs of the company, &c. There can be no doubt that the stock in such an undertaking will yield a handsome profit.

It will be observed that a road-way, constructed upon the above plan, leaves the river entirely unobstructed; that the arch is completely out of the reach of injury from the river; that it is permanent, solid, and will last for ever; and that it involves but a trifling expense to keep it in order for constant use.

Internal Improvement.—*Great Railroad from New-York to Washington, through Philadelphia and Baltimore.*—The continuous line of railroad which is intended to run uninterruptedly from New-York to Washington, through Philadelphia and Baltimore, is undoubtedly one of the most magnificent works of the present day, either in this country or in Europe. In point of extent it far surpasses any line yet possessing the slightest prospect of completion in the United States.

The series of railroads from New-York to Washington, under different charters, granted by different States, which combined into one continuous line, uniting the two large and all the intermediate cities in question, could be completed, *but for one obstacle*, in probably one year or eighteen months. This obstacle is the small section of 26 miles between Trenton and New-Brunswick, in New-Jersey; a section which is indeed under the operation of a charter for one of the old fashioned turnpike companies, but does not, *at present*, possess those powers of transportation and management which are necessary to transform it into a railroad.

We have procured from the best sources of information a full and accurate statement of the present condition and prospects of the whole series of these railroads, which, combined, will bring New-York and Washington within eight hours distance of each other, and of course, all the intermediate cities in like proportion. This information is so interesting that we cannot deny ourselves the pleasure of communicating it to the public.

And first, the railroad from Washington to Baltimore. The length of this section is 37 miles, being a branch of what is called the Baltimore and Ohio Railroad, chartered under the joint powers of Congress, and of the State of Maryland. This road is now in the process of construction. A large section is finished, and it is believed that it could be completed in less than a year.

2. From Baltimore to Port Deposite Bridge on the Susquehanna. This section is also chartered by the State of Maryland—the stock subscribed, the route surveyed and located, and could be put under contract and finished with great expedition. The road is nearly straight and very level—the only exception being a very small sweep up Port Deposite Bridge. Length of this section 41¼ miles.

3. From Port Deposite Bridge to the Maryland and Pennsylvania line,—distance 10 miles. This section is also chartered, the stock subscribed, route surveyed and located, and only waits the action of the New-Jersey Legislature upon the Trenton and New-Brunswick section.

4. From the Maryland and Pennsylvania line to the Columbia Railroad, near Coatesville,—distance 20½ miles. This section is also chartered, surveyed and located, being in the same situation as the two preceding sections. From Coatesville to the Susquehanna, the ground is particularly well adapted for a rail-road. The line laid out runs along a gentle ridge, almost level the whole distance till it descends the bank of the Susquehanna. The ground resembles the famous ridge road of Western New-York.

5. From Coatesville on the Columbia Railroad to Broad street, Philadelphia,—distance 45½ miles. This is now in use. Not a word need be said of this section to a Philadelphia reader. It is crowded daily with passengers.

6. From Broad street, through the Northern Liberties, &c. to the Delaware river,—distance one mile. Nothing need be said of this short cut.

7. From Philadelphia to Trenton Bridge,—distance 26½ miles. This section we have already described. It is nearly completed, and will be ready for the locomotive before the termination of the season.

8. From Trenton Bridge to New-Brunswick,—distance 26½ miles. This is the only section throughout the whole line, from Washington to New-York, that is not chartered for a railroad. It is the construction of this section in which exists the whole obstacle to the completion of a line of railroad that would confer lasting benefits on the whole Atlantic seacoast—but of this, more anon.

9. From New-Brunswick to Jersey City, opposite New-York,—distance 30¼ miles. This section will be completed and ready for trade next year—more than half will be ready this season.

Thus, at one view, we have a continuous line of railroads through the whole route from New-York to Washington, a distance of 239¼ miles, including the breadth of the North River, that could be constructed and made ready for travelling in about a year from this date, provided the Legislature of New-Jersey would remove the only obstacle that stands in the way of such a magnificent improvement.—[Phil. Inq.]

The Ohio and Chesapeake and Pennsylvania Canals, with a few subsequent Remarks relative to Canals and Railroads in general.

To the Editor of the Railroad Journal:

As an unfavorable impression may arise in regard to the above important improvements, by reading the remarks of "Civis," in the Journal of the 16th of August,* I take the liberty of giving some facts, and my views of the canals under consideration.

The Pennsylvania canal and railroad from Philadelphia to Pittsburg, at the head of steamboat navigation on the Ohio river, is about 400 miles. The Chesapeake and Ohio Canal, from Washington City to the same place, is expected to be about 350 miles. These canals must and will form the great outlet to the western trade bordering upon the great rivers of the west. The steamboat navigation to which these canals are connected is not less in extent than twelve thousand miles, and the country exhibits a population of not less than three millions of inhabitants, residing in the States of Louisiana, Mississippi, Missouri, Tennessee, Illinois, Indiana, Kentucky, Ohio, Virginia, and Pennsylvania; and from the great increase now taking place in this population, we may safely estimate the population in 1840 to four millions of inhabitants. Three hundred pounds would be a low calculation to assume as the average available tonnage from each inhabitant annually; but at this calculation, four millions of inhabitants will give an annual tonnage to the canals and other channels of commerce of 600,000 tons. Half of this tonnage must from indubitable circumstances pass through these great canals. Already have goods passed through the Pennsylvania Canal for the different States before enumerated, and circumstances indicate that, during the year of 1835, Pennsylvania will receive one million of dollars in toll from her canals; besides, being rapidly on the increase, will, as a revenue matter, outstrip the New-York canals as much as the relative proportion of population to which these canals give vent.

Already have I made it appear that 300,000 tons would necessarily pass the Pennsylvania and Ohio and Chesapeake Canals, should they be completed by the year 1840. Suppose this tonnage be equally divided betwixt those canals: 150,000 tons will pass through each, and at an average rate of $8 per ton, for toll, will give a revenue of $1,200,000 per annum to each, and this independent of that which will be derived from the inhabitants along those lines, which together will equal one million and a half as the revenue to each canal.

I have no doubt but two or three more years of experience on the Pennsylvania Canal will fully justify my calculations; and the Chesapeake and Ohio Canal will no longer linger for the want of funds, but capitalists will anxiously seek an investment in the stock of this company. This canal is estimated to cost about ten millions of dollars, and from the foregoing calculation, will yield, clear of all expenses, about twelve per cent. on the investment.

Thus far I have said nothing as to the relative advantages of canals and railroads. I have no disposition to disparage railroads as a means of communication; on the contrary, I consider them a valuable kind of improvement, highly beneficial in their place, and next to canals as a means of communication for the surplus products of our country, but *superior* to canals where travelling or speed is the great end to be gained.

I think it highly improper on the part of "Civis,"—who, it appears, does not understand the situation and probable effects of some of the canals of which he makes an unwarrantable assertion, that their stock will be unprofitable,—thus to attempt to injure improvements of a highly important cast, for the mere purpose of advancing a favorite system.

Let canals first be made from the Atlantic cities to the great western waters, and then railroads will follow in their train. The State of New-York has already arrived at the time when a railroad nearly parallel with her great canal is necessary in order to insure to her the paramount advantage which nature has placed at her disposal over the lake trade.

The canal, in a comparative sense, is the draft horse, while the railroad is the horse for speed. These in conjunction form every facility for an agricultural, manufacturing, and commercial community, of which they can be possessed as a means of artificial communication. They are or ought to be co-laborers in the great cause of advancing the social intercourse, and extending more widely the blessings to be derived from a free interchange of sentiment. The advocates of canals and railroads should therefore unite their interests: it

* See Mechanics' Magazine, vol. iv., page 127.

is no longer problematical as to the relative advantages of the two kinds of improvement.

Sufficient has already been done to satisfy every practical man wherein the great advantage of each improvement consists.

Yours, &c. L——.

August 26, 1834.

NEW IMPROVEMENT IN WASHING MACHINES.—One would suppose that Yankee ingenuity had become well nigh exhausted upon washing machines: but we have lately examined a new invention, or rather a modification of an old system, by Mr. James Pullen, of China. His plan is upon the common fluted washboard, but his flutings are made of sheets of copper, zinc, tin—or they may be made of glass, earthen, or similar durable and smooth substances. These sheets or substances are fastened to boards, and used as such boards are commonly used. Now where's the improvement?—1st, In durability; 2d, In its smoothness; and 3d, Ease in performing the operation of rubbing. A common washboard does not last long—it soon gets rough, of course wears out the clothes and makes harder work; they get warped and split, are then patched up with shingle nails, which get rusty, and make a rickety, weak concern; the women scold, and the poor husband has to march off and buy a new one. The metallic rubber will last a long life time, if, a little care be taken in drying it after using; for when worn a little on one side it may be turned and worn on the opposite side, and in the contrary direction.

We like the simplicity of the concern. Our washing machines have been too complicated. The inventors seem to have considered it necessary to show their skill in combining the greatest number of mechanical modifications in one piece; and the greater the array of cog-wheels, cranks and rollers, the more ingenious has the machine been considered, and the more likely to do its duty without hands. Disappointment has of course followed. This improvement is simple, and promises no more than it can perform. It does not promise to indulge idleness, and to do away the labor of washing; but to lighten and facilitate that labor, and render it a pleasure, rather than a dreaded task. Mr. Pullen has left one of them at our office for the inspection of those who wish to examine it.—[Maine Farmer.]

THE WEATHER.—From the valuable table kept by Mr. McAllister, Optician, we have ascertained the following facts in relation to the heat in this city for the last ten years, during the months of June, July, and August. It may hereafter serve as a good table of reference.

The same thermometer, placed in the same situation, and in the shade, has been used during the whole period of time.

The day selected in each month has been that on which the thermometer stood highest at noon, at which hour the record was made.

1824	June 7th	97
	July 2d	95½
	August 9th	90
1825	June 21st	100
	July 22d	100
	August 15th	94½
1826	June 3d	94½
	July 13th	95½
	August 2d	90½
1827	June 20th	90
	July 3d	96½
	August 6th	99
1828	June 28th	96½
	July 24 & 25 each	95½
	August 1st	96
1829	June 20th	92½
	July 23d	96½
	August 14th	92½
1830	June 16th	98
	July 27th	97
	August 16th	94
1831	June 3d	96
	July 23d	96½
	August 17th	93½
1832	June 25 & 26 each	91½
	July 7th	93
	August 7th	93½
1833	June 15th	90
	July 22d	94
	August 14th	89
1834	June 7th	91½
	June 10th	96
	July 8th	96
	July 9th	96½
	July 16th	96
	July 24th	99
	July 26th	97½
	August 5th	95½

Average Heat of each month for ten years.

	June.	July.	August.
1824	81.3	86.2	79.8
1825	84.6	88.7	81.7
1826	82.5	85.4	82.7
1827	80.2	86.3	84.5
1828	87.0	87.1	85.8
1829	80.1	84.1	83.3
1830	80.3	87.9	83.0
1831	85.6	86.9	85.4
1832	80.3	84.9	82.7
1833	77.0	83.7	81.1
1834	81.4	89.5	

On Thursday, the 8th of July, between one and two o'clock, the thermometer rose to 100½. On Tuesday, August 5, at half-past one o'clock, it stood 100½ degrees, being the warmest day this season.—[Phil. Herald.]

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum *in advance*.—JOHN KNEASS (formerly proprietor of the London Mechanics' Magazine,) Editor.

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AND

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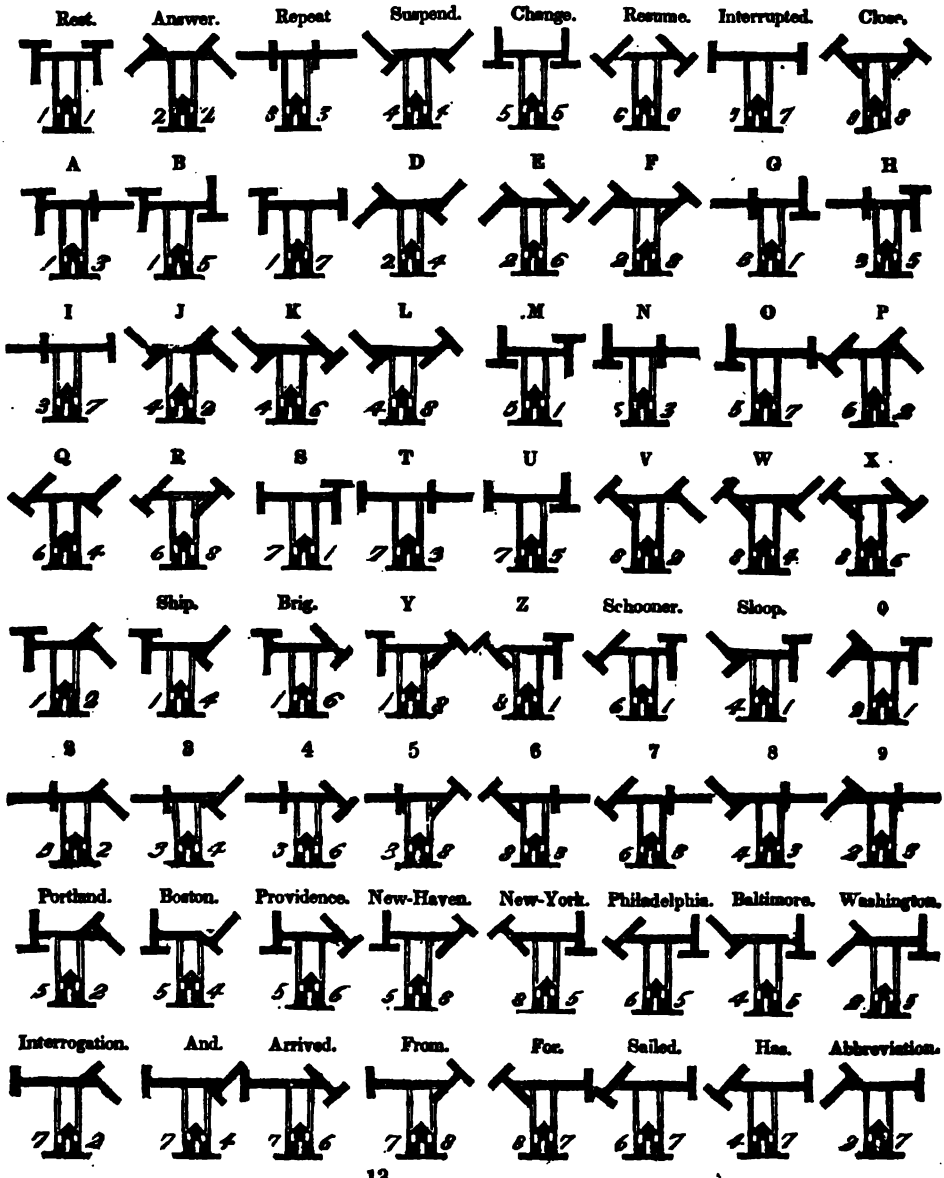
"Men are often capable of greater things than they perform: they are sent into the world with bills of credit, and seldom draw to their full extent."—HORACE WALPOLE.

SCALE OF SIGNALS OF PORTER'S IMPROVED TELEGRAPH.



Improved Telegraph.

To the Editor of the Mechanics' Magazine

SIR,—I have for several years had on hand a model and set of drawings of an improved telegraph, calculated for inland communication, and by the use of which any piece of information which may be expressed by one hundred alphabetic letters may be conveyed from New-York to Boston in sixteen minutes. I have hitherto, on account of a press of other business, neglected to submit my plans either to the public, or to such individuals as would be likely to take an interest in the improvement. The number of stations requisite to constitute a line from New-York to Boston would be twelve. The whole expense of establishing a line will not exceed six hundred dollars. The expense of attendance is estimated at twelve dollars a day. A reasonable price for communicating intelligence would be one cent per letter. Ten letters per minute may be passed through the line, which would amount to more than sixty dollars a day when the telegraph was kept employed. I make these statements to encourage any one who may find it convenient to establish such a line, and to whom I should tender the use of my improvement, with such assistance as I could render, for a small share of the profit thereof. Among the employers of a telegraphic line would be the masters of vessels belonging to one port and arriving at the other. The arrival of all regular packets, and all the important arrivals from foreign ports, would be telegraphed at the expense of the owners; and items of important foreign or domestic news at the expense of the editors who should first publish the same in the places where such information should be received by telegraph; drawings of lotteries, at the expense of the managers; and even individuals arriving at Boston from New-York (or vice versa) would willingly pay twenty-five cents to inform their anxious families or friends, in ten minutes' time, of their safe arrival. The following is the specification of the telegraph:

Two posts, about sixteen feet high, are set permanently in the ground about five feet apart. The heads of the posts are tennoned to a horizontal beam sixteen feet long, each end projecting six feet beyond the posts. Near each end of the beam is a T, consisting of two planks, one of which is ten feet long and sixteen inches wide; and the other, which is seven feet long and two feet wide, crosses one end of the first, to which it is secured by nails. Each T is mounted on a pivot, or bolt, which passes through the T at the point of its centre of gravity; to the centre of the T is also attached a wheel, two inches thick and two feet in diameter; so that the pivot-bolt passes through both the T and wheel into the side of the beam. Between the two posts is a *watch-box*, (or shelter for the signalist,) in the middle of which is a post or vertical plant six inches wide, from each edge of which eight small hooks or pins project, being nine inches apart. Each row of hooks is numbered from the top downward, from one to eight inclusive. The first hook sustains a ring, from which a rope extends upward to the beam, where it passes over a small pulley; thence horizontally to the upper side of the T wheel, to which it is made fast by a staple, after passing once round, (the wheel having a groove in its periphery.) The rope thence continues over a part of the wheel, and from the lower side horizontally to another pulley on one of the main posts; thence downward nearly to the bottom of the watch-box, inside, where it is attached to a fourteen pound weight, which is thereby suspended. By this arrangement, it will be seen, that when the ring is hauled down to any of the other hooks, the weight is raised, and the position of the T is changed; and when the ring is returned, the weight returns the T also to its first position. Thus, by changing the places of the two rings, on their respective rows of hooks, the T's will present sixty-four distinct positions, twenty-six of which represent the letters of the alphabet, and the remainder have each a signification suitable for facilitating communications.

I claim the construction of the telegraph, and the arrangement of the scale, as far as above specified. RUFUS PORTER.

Billerica, Mass., Sept. 2, 1834.

NOTE.—The leader of the signals may frequently avail himself of abbreviations, such as S B for steamboat, C N for communication, &c. adding the signal of abbreviation in each instance.

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 170.]

GEOMETRY.

Q. What is geometry?

A. The science of quantity, quality, or magnitude, abstractedly considered.

Q. Enumerate the several definitions and axioms laid down in the theory and practice of geometry.

A. 1. A Point is that which has position,

but no magnitude nor dimensions; neither length, breadth, nor thickness.

2. A Line is length, without breadth, or thickness.

3. A Surface or Superficies is an extension, or a figure of two dimensions, length and breadth, but without thickness.

4. A Body or Solid is a figure of three dimensions, namely, length, breadth, and depth, or thickness.

5. Lines are either Right or Curved, or Mixed of these two.

6. A Right Line, or Straight Line, lies all in the same direction between its extremities, and is the shortest distance between two points.

When a line is mentioned simply, it means a right line.

7. A Curve continually changes its direction between its extreme points.

8. Lines are either Parallel, Oblique, Perpendicular, or Tangential.

9. Parallel Lines are always at the same perpendicular distance; and they never meet, though ever so far produced.

10. Oblique Lines change their distance, and would meet if produced on the side of the least distance.

11. One line is perpendicular to another, when it inclines not more on one side than the other, or when the angles on both sides of it are equal.

12. A line or circle is Tangential, or is a Tangent to a circle, or other curve, when it touches it, without cutting, although both are produced.

13. An Angle is the inclination or opening of two lines, having different directions, and meeting in a point.

14. Angles are Right or Oblique, Acute or Obtuse.

15. A Right Angle is that which is made by one line perpendicular to another, or when the angles on each side are equal to one another they are right angles.

16. An Oblique Angle is that which is made by two oblique lines, and is either less or greater than a right angle.

17. An Acute Angle is less than a right angle.

18. An Obtuse Angle is greater than a right angle.

19. Superficies are either Curved or Plane.

20. A Plane Superficies, or a Plane, is that with which a right line may every way coincide. Or if the line touch the plane in two points, it will touch it in every point; but if not, it is curved.

21. Plane Figures are bounded either by right lines or curves.

22. Plane figures that are bounded by right lines have names according to the number of their sides, or of their angles; for they have as many sides as angles, the least number being three.

23. A figure of three sides and angles is called a Triangle; and it receives particular denominations from the relations of its sides and angles.

24. An Equilateral Triangle is that whose three sides are all equal.

25. An Isosceles Triangle is that which has two sides equal.

26. A Scalene Triangle is that whose three sides are all unequal.

27. A Right-angled Triangle is that which has one right angle.

28. Other triangles are oblique angled, and are either obtuse or acute.

29. An Obtuse-angled Triangle has one obtuse angle.

30. An Acute-angled Triangle has all its three angles acute.

31. A figure of four sides and angles is called a Quadrangle, or a Quadrilateral.

32. A Parallelogram is a quadrilateral which has both its pairs of opposite sides parallel; and it takes the following particular names, viz. Rectangle, Square, Rhombus, Rhomboid.

33. A Rectangle is a parallelogram having a right angle.

34. A square is an equilateral rectangle, having its length and breadth equal, or all its sides equal, and all its angles equal.

35. A Rhomboid is an oblique-angled parallelogram.

36. A Rhombus is an equilateral rhomboid, having all its sides equal, but its angles oblique.

37. A Trapezium is a quadrilateral which hath not its opposite sides parallel.

38. A Trapezoid has only one pair of opposite sides parallel.

39. A Diagonal is a line joining any two opposite angles of a quadrilateral.

40. Plane figures that have more than four sides are in general called Polygons: and they receive other particular names, according to the number of their sides or angles. Thus—

41. A Pentagon is a polygon of five sides; a Hexagon, of six sides; a Heptagon, seven; an Octagon, eight; a Nonagon, nine; a Decagon, ten; an Undecagon, eleven; and a Dodecagon, twelve sides.

42. A Regular Polygon has all its sides and all its angles equal. If they are not both equal, the polygon is Irregular.

43. An Equilateral Triangle is also a Regular Figure of three sides, and the Square

is one of four: the former being also called a Trigon, and the latter a Tetragon.

44. Any figure is equilateral when all its sides are equal: and it is equi-angular when all its angles are equal. When both these are equal, it is a regular figure.

45. A Circle is a plane figure bounded by a curve line called the Circumference, which is every where equidistant from a certain point within called its Centre.

The circumference itself is often called a circle, and also the Periphery.

46. The Radius of a circle is a line drawn from the centre to the circumference.

47. The Diameter of a circle is a line drawn through the centre, and terminating at the circumference on both sides.

48. An Arc of a circle is any part of the circumference.

49. A Chord is a right line joining the extremities of an arc.

50. A Segment is any part of a circle bounded by an arc and its chord.

51. A Semi-circle is half the circle, or a segment cut off by a diameter.

The half circumference is sometimes called the Semi-circle.

52. A Sector is any part of a circle which is bounded by an arc, and two radii drawn to its extremities.

53. A Quadrant, or Quarter of a circle, is a Sector having a quarter of the circumference for its arc, and its two radii are perpendicular to each other. A quarter of the circumference is sometimes called a Quadrant.

54. The Height or Altitude of a figure is a perpendicular let fall from an angle, or its vertex, to the opposite side called the base.

55. In a right-angled triangle, the side opposite the right angle is called the Hypothenuse, and the other two sides are called the Legs, and sometimes the Base and Perpendicular.

56. When an angle is denoted by three letters, of which one stands at the angular point, and the other two on the two sides, that which stands at the angular point is read in the middle.

57. The circumference of every circle is supposed to be divided into 360 equal parts, called Degrees, and each Degree into 60 Minutes, each Minute into 60 Seconds, and so on. Hence, a semi-circle contains 180 degrees, and a quadrant 90 degrees.

58. The Measure of an angle is an arc of any circle contained between the two lines which form that angle, the angular point being the centre; and it is estimated by the number of degrees contained in that arc.

59. Lines or chords are said to be Equidistant from the centre of a circle, when perpendiculars drawn to them from the centre are equal.

60. And the right line on which the Greater Perpendicular falls is said to be farther from the centre.

61. An Angle In a segment is that which is contained by two lines, drawn from any point in the arc of the segment to the two extremities of that arc.

62. An Angle On a Segment, or an arc, is that which is contained by two lines, drawn from any point in the opposite or supplemental part of the circumference, to the extremities of the arc, and containing the arc between them.

63. An Angle, at the circumference, is that whose angular point is any where in the circumference. And an angle at the centre is that whose angular point is at the centre.

64. A right-lined figure is Inscribed in a circle, or the circle Circumscribes it, when all the angular points of the figure are in the circumference of the circle.

65. A right-lined figure Circumscribes a circle, or the circle is Inscribed in it, when all the sides of the figure touch the circumference of the circle.

66. One right-lined figure is Inscribed in another, or the latter circumscribes the former, when all the angular points of the former are placed in the sides of the latter.

67. A Secant is a line that cuts a circle, lying partly within and partly without it.

68. Two triangles, or other right-lined figures, are said to be mutually equilateral, when all the sides of the one are equal to the corresponding sides of the other, each to each; and they are said to be mutually equiangular when the angles of the one are respectively equal to those of the other.

69. Identical figures are such as are both mutually equilateral and equiangular, or that have all the sides and all the angles of the one respectively equal to all the sides and all the angles of the other, each to each; so that if the one figure were applied to, or laid upon the other, all the sides of the one would exactly fall upon and cover all the sides of the other; the two becoming as it were but one and the same figure.

70. Similar figures are those that have all the angles of the one equal to all the angles of the other, each to each, and the sides about the equal angles proportional.

71. The Perimeter of a figure is the sum of all its sides taken together.

72. A Proposition is something which is either proposed to be done or to be demonstrated, and is either a problem or a theorem.

73. A Problem is something proposed to be done.

74. A Theorem is something proposed to be demonstrated.

75. A Lemma is something which is premised or demonstrated, in order to render what follows more easy.

76. A Corollary is a consequent truth, gained immediately from some preceding truth or demonstration.

77. A Scholium is a remark or observation made upon something going before it.

AXIOMS.

1. Things which are equal to the same thing are equal to each other.

2. When equals are added to equals, the wholes are equal.

3. When equals are taken from equals, the remainders are equal.

4. When equals are added to unequals, the wholes are unequal.

5. When equals are taken from unequals, the remainders are unequal.

6. Things which are double of the same thing, or equal things, are equal to each other.

7. Things which are halves of the same thing are equal.

8. Every whole is equal to all its parts taken together.

9. Things which coincide, or fill the same space, are identical, or mutually equal in all their parts.

10. All right angles are equal to one another.

11. Angles that have equal measures, or arcs, are equal.

RATIOS AND PROPORTIONS.

1. Ratio is the proportion or relation which one magnitude bears to another magnitude of the same kind, with respect to quantity.

Note—The measure or quantity of a ratio is conceived, by considering what part or parts the leading quantity, called the Antecedent, is of the other, called the Consequent; or what part or parts the number expressing the quantity of the former is of the number denoting, in like manner, the latter. So the ratio of a quantity expressed by the number 2, to a like quantity expressed by the number 6, is denoted by 2 divided by 6, or three sixths, or one third: the number 2 being 3 times contained in 6, or the third part of it. In like manner, the ratio of the quantity 3 to 6 is measured by three sixths, or one half; the ratio of 4 to 6 is four sixths, or two thirds; that of 6 to 4 is six fourths, or three halves, &c.

2. Proportion is an equality of ratios. Thus—

3. Three quantities are said to be proportional, when the ratio of the first to the second is equal to the ratio of the second to the third. As of the three quantities A (2), A (4), C (8), where two fourths are equal to four eighths, and one half, both the same ratio.

4. Four quantities are said to be proportional, when the ratio of the first to the second is the same as the ratio of the third to the fourth. As of the four, A (4), B (2), C (10), D (5), where four halves are equal to ten fifths and 2, both the same ratio.

Note—To denote that four quantities, A, B, C, D, are proportional, they are usually stated or placed thus, A : B : : C : D; and read thus, A is to B as C is to D. But when three quantities are proportional, the middle one is repeated, and they are written thus, A : B : : B : C.

The proportionality of quantities may also be expressed very generally by the equality of fractions. Thus, if $\frac{A}{B} = \frac{C}{D}$, then A : B : : C : D, also B : A : : C : D, and A : C : : B : D, and C : A : : B : D.

5. Of three proportional quantities, the middle one is said to be a Mean Proportional between the other two; and the last, a Third Proportional to the first and second.

6. Of four proportional quantities, the last is said to be a Fourth Proportional to the other three, taken in order.

7. Quantities are said to be Continually Proportional, or in Continued Proportion, when the ratio is the same between every two adjacent terms, namely, when the first is to the second as the second to the third, as the third to the fourth, as the fourth to the fifth, and so on, all in the common ratio.

As in the quantities 1, 2, 4, 8, 16, &c. where the common ratio is equal to 2.

8. Of any number of quantities, A, B, C, D, the ratio of the first, A, to the last, D, is said to be Compounded of the ratios of the first to the second, of the second to the third, and so on to the last.

9. Inverse ratio is when the antecedent is made the consequent, and the consequent the antecedent. Thus, if 1 : 2 : : 3 : 6, then, inversely, 2 : 1 : : 6 : 3.

10. Alternate proportion is when antecedent is compared with antecedent, and consequent with consequent, as, if 1 : 2 : : 3 : 6, then, by alternation, or permutation, it will be 1 : 3 : : 2 : 6.

11. Compound ratio is when the sum of the antecedent and consequent is compared, either with the consequent or with the antecedent. Thus, if 1 : 2 : : 3 : 6, then, by

composition, 1 plus 2 : : 3 plus 6 : 3, and 1 plus 2 : 2 : : 3 plus 6 : 6.

12. Divided ratio is when the difference of the antecedent and consequent is compared, either with the antecedent or with the consequent. Thus, if 1 : 2 : : 3 : 6, then, by division, 2—1 : 1 : : 6—3 : 3, and 2—1 : 2 : : 6—3 : 6.

Note—The term Divided, or Division, here means subtracting or parting; being used in the sense opposed to compounding or adding, in def. 11.

PLANES AND SOLIDS.

1. The Common Section of two Planes is the line in which they meet or cut each other.

2. A Line is Perpendicular to a Plane, when it is perpendicular to every line in that plane which meets it.

3. One Plane is Perpendicular to another, when every line of the one which is perpendicular to the line of their common section is perpendicular to the other.

4. The Inclination of one Plane to another, or the angle they form between them, is the angle contained by two lines drawn from any point in the common section, and at right angles to the same, one of these lines in each plane.

5. Parallel Planes are such as, being produced ever so far both ways, will never meet, or which are every where at an equal perpendicular distance.

6. A Solid Angle is that which is made by three or more plane angles meeting each other in the same point.

7. Similar Solids contained by plane figures are such as have all their solid angles equal, each to each, and are bounded by the same number of similar planes alike placed.

8. A Prism is a solid whose ends are parallel, equal, and like plane figures, and its sides connecting those ends are parallelograms.

9. A Prism takes particular names, according to the figure of its base or ends, whether triangular, square, rectangular, pentagonal, hexagonal, &c.

10. A Right or Upright Prism is that which has the planes of the sides perpendicular to the planes of the ends or base.

11. A Parallelopiped, or Parallelopipedon, is a prism bounded by six parallelograms, every opposite two of which are equal, alike, and parallel.

12. A Rectangular Parallelopipedon is that whose bounding planes are all rectangles, which are perpendicular to each other.

13. A Cube is a square prism, being bounded by six equal square sides or faces, which are perpendicular to each other.

14. A Cylinder is a round prism, having circles for its ends; and is conceived to be formed by the rotation of a right line about the circumferences of two equal and parallel circles, already parallel to the axis.

15. The Axis of a Cylinder is the right line joining the centres of the two parallel circles about which the figure is described.

16. A Pyramid is a solid, whose base is any right lined plane figure, and its sides triangles, having all their vertices meeting together in a point above the base, called the vertex of the pyramid.

17. A Pyramid, like the prism, takes particular names from the figure of the base.

18. A Cone is a round pyramid, having a circular base; and is conceived to be generated by the rotation of a right line about the circumference of a circle, one end of which is fixed at a point above the plane of that circle.

19. The Axis of a Cone is the right line joining the vertex or fixed point, and the centre of the circle about which the figure is described.

20. Similar Cones and Cylinders are such as have their altitudes and the diameters of their bases proportional.

21. A Sphere is a solid bounded by one curve surface, which is every where equally distant from a certain point within, called the Centre. It is conceived to be generated by the rotation of a semi-circle about its diameter, which remains fixed.

22. The Axis of a Sphere is the right line about which the semi-circle revolves; and the centre is the same as that of the revolving semi-circle.

23. The Diameter of a Sphere is any right line passing through the centre, and terminated both ways by the surface.

24. The Altitude of a Solid is the perpendicular drawn from the vertex to the opposite side or base.

On the Comparative Value and Importance of Mathematical Science, and on the Pretensions of its Professors. [From the London Mechanics' Magazine.]

(Continued from page 186.)

Let us take other views of mathematicians and practical men bending their faculties towards the attainment of the same object. The most valuable method of determining the longitude was at last accomplished through practical means, and by practical men. Euler aimed to produce an achromatic lens as well as Dolland, but it was the latter who succeeded; and their respective modes of proceeding mark both the

character and comparative value of their efforts. As to the steam engine, science (other than the most common) cannot lay a particle of claim to it. It is the all-important gift to the world from practical men alone. One was a miner, another was a blacksmith, a third was a glazier, and a fourth a watchmaker. Science has not even now elucidated all its principles,—one important point is as obscure at the present day as ever it was. During the time this mighty engine was maturing, and having for its ultimate effect a political, a moral, and a social revolution throughout the whole earth, the mathematicians of the foreign academies, the Eulers, and the Bernouilles, even when engaged on physico-mathematical subjects, were exciting each other's ingenuity, and eliciting their mutual admiration, by very profound but very sterile inquiries into things selected purposely and merely for the opportunity they afforded for the most abstruse and difficult investigations. Such was that concerning the gyratory motion of a body fastened to an *extensible* thread, first in a horizontal plane, and then, for the sake of the choice piece of complication produced by the introduction of the force of gravity, in a vertical plane, but ending at last with a suspicion that all was wrong. Such was that on the formulæ for determining the motion of a thread perfectly flexible, ending in unmanageable equations. And such was that concerning tractory and compound tractory curves, formed by a weight in one case, and two or more weights in the other, being moved by a thread whose end travels along a line either straight or curved, ending also unsatisfactorily. *Your* Magazine, Mr. Editor, is also the theatre occasionally for the display and sharpening of the wits of certain geometrical correspondents. Such was the tendency of the problem lately proposed and solved—"To inscribe a quadrilateral in a given circle, having given each of the diagonals and area." Why should not these have their puzzles as well as the more profound analysts? They form good school-boy exercises, and school-boys accordingly have sustained a conspicuous part on your stage. Some persons are particularly apt at such questions, and so are others at solving riddles. The different manner in which the proposal for an undulating in lieu of a level railway has been received by the *mere* mathematicians on the one hand, and by the body of civil engineers on the other, is also abundantly significant of the comparative rank and importance which the former hold in the scale of intellect and utility. Your correspondents, Kinclaven, Iver Maciver, and M. S., are mathematicians—geometricians, at any rate—and they have sided with Mr. Badnall. Be it so—the impress is of their own stamping, and the currency is their own issue.

The limits to which I am confined will permit me merely to allude, and only, to a few more instances of the unfitness of the mere mathematician for physical inquiries, and of the unsatisfactory applications of their science. At one time the animal economy was mathematically and mechanically explained. The treatises on physiology were filled with problems, long calculations, and algebraic formulæ. Lawrence says, "that one estimated the force of the heart as equal to 180,000 pounds; another reduced it to 8 oz.; and both these conclusions are deduced from reasonings clothed in all the imposing forms of the *exact* sciences."

Even the phenomena of the mind have been forced within the pale of mathematical disquisition. Hartley's elaborate hypothesis of the *vibratory* nature of thought and feeling would afford a choice and subtle theme for analysts of the French school, if only a few facts could be found to give it a coloring of truth, and a plausible pretence for the application of the calculus. We may then hope to find an expression for the velocity of our ideas, with the corrections due to variations in the temperature, moisture, and tension of the medullary fibre!

To come to our own times, there is Sir R. Phillips' theory *of all things*—ingenious enough, but that is all. Then there is Mr. Herepath's mathematico-chemical theory, accompanied with a challenge to the Royal Society, and preposterously backed with an offer to wager £1000 on the issue, in which the molecules of the gases are continually jostling each other and perpetually at loggerheads. The whole scheme is, however, mathematically and demonstrably true, especially if reasoning in a circle be only a circuitous way to truth.* Then there is the more measured movement of the ultimate particles of matter according to the theory of Mr. Emmet, by reason of the altered ratio of the forces which previously held them in equilibrium—the disturbing force being calo-

* This conspicuous herald of his own and Mr. Gurney's fame will surely be satisfied if his theory be as true as his assertion, that Mr. Gurney's steam-drag would transfer the same weight as it does on a common road, "*two hundred and sixty* or *two hundred and eighty* miles per hour on a railway, supposing mechanical laws followed, and that the materials and the resistance of the atmosphere would allow it." A slight mistake this—identical with Kinclaven's, of supposing the expenditure of power not to follow the ratio of the velocity as well as the resistance. This is another instance, by-the-by, on the part of both these persons, (for they are one only in error, I imagine,) of mathematical fitness and sagacity for physical inquiries.

ric. More recently there is the somewhat similar, but more elaborate and comprehensive, atomic theory of Mr. Exley, a work which I approach with the greatest respect, for the many profound, ingenious, and philosophic views with which it abounds; and for the very numerous explanations of phenomena which he adduces in accordance with his hypothesis, and which give it a much less speculative cast than the theories previously mentioned. The laws, however, which govern the immediate action of the atoms, if such there be, are probably not scrutable to our means or faculties; and it must be doubted whether our knowledge, even of the elements of matter, is sufficiently advanced to admit of such mathematical disquisitions: the attempt at present appears to be premature, though possibly it may be ultimately successful; and, in the mean time, the experimental researches of philosophers, with Mr. Faraday at their head, will be more useful, and teem with results of greater consequence. What an important though simple fact has lately been brought to light by this gentleman, and how much of a practical character there is about it, that the chemical action of platina in certain cases depends on its being perfectly *clean*,—a circumstance which your very profound thinker, with his algebraic formulæ, would run every chance of overlooking, because it is just on the surface of things. The sagacious practitioner having his attention alive to every incident, attaches no undue importance to what is recondite, or undervalues any thing because it has not the air of being scientific or *recherche*.

I have thus endeavored to mark the peculiar deficiencies for just reasoning and original investigation, to which the mere mathematician is liable from the biassing tendency of his studies, the natural bent of his mind, and the engrossing occupation of his time. I have illustrated this position with as many instances as my limits will allow, and I have incidentally shadowed forth the true and philosophic mode of conducting inquiries into the mixed and complex affairs which surround us on every hand. In pursuing this subject, there are one or two points on which I wish to guard against misapprehension. It is not intended, then, to impugn any of the methods adopted by the mathematicians in their own science, as purely considered, however they may have differed among themselves respecting them. Still less is it intended to impugn the modes of procedure adopted in the mixed mathematics, or to complain of what has been *fitly* done herein; but rather of what has not been so done—of premature applications of the science before the phenomena of nature have been sufficiently investigated to warrant an hypothesis—of inadequate applications, from a too great sacrifice of physical considerations in deference to the exactness of science—of partial applications being assumed to be complete, or, at any rate, to be of greater pretension and value than avowedly irregular but more comprehensive modes of considering the subject,—and of such applications being put forward in lieu of, and in preference to, tentative proceedings, even when the case points to and admits of their being adopted. Neither is it intended that those observations, or mere hints, rather, concerning the true and more ample mode of philosophising, should point to the analytic more than to the synthetic method, for they refer to both; and the reference is also as much to the secret mental process as to the published and formal procedures. The former is a curious subject, of which scarcely any thing can be known, and the little we can conjecture of it must arise from a knowledge of what passes in our own minds. How intensely interesting would it be to have before us the workings of such a mind as Newton's, whilst maturing his immortal system. We have a glimpse of such things in what is told of Kepler—of his shrewd guesses, tentative methods, and ultimate success in discovering by these means the two laws of the planetary motions which bear his name; and also in what is related of the cut and weighed paper proceedings of some of the geometricians. The results, of course, appeared in systematic mood and scientific dress. The works of Newton gave evidence of certain secret and facile means, before the method of fluxions was announced or known. We have also, in the detail of the experiments which led Sir Humphry Davy to the discovery of the miners' safety lamp, an interesting instance of this mental process, at least of the general course of his thoughts. We are not to imagine that the analysis or synthesis, as brought forth to public view, is in its mental elaboration a direct and straightforward affair. Doubtless there are alternated or mingled methods of resolution and composition, of experiment, tentation, and verification, in a round of mixed proceedings; but from this seeming chaos of thought the plastic spirit of true philosophy evolves coherent forms of symmetry, of truth, and beauty. The heart of man is a secret thing; but the mind of man is yet more impenetrable. I would also wish to be understood as not contemning mathematical acquirements in the slightest degree, but as pleading for their use in opposition to their abuse, and as moderating only the overweening pretensions

of their value and importance, both in an intellectual and useful point of view, in which the *mere* mathematician is apt to indulge.

It may be expected from me that I should apologise for assuming the censor in such sort. I beg, then, in justification and corroboration of my opinions, to quote the following sentiments, which have come under my notice since the preceding observations were written—in fact, the treatise in which they appear is just published: "In mathematics we go smoothly on, neither turning to the right hand nor to the left; there is, in fact, no alternative presented to the mind—we cannot do otherwise than give our assent to what is before us. There is no weighing, no balancing of collateral evidence, or consideration of circumstances, such as often clog and impede our progress in many of the other branches of knowledge. How often do we hear mathematicians bewail the difficulties they meet with when they wander from their own folds; and how often do we hear them give utterance to the pleasing but forlorn hope of seeing all knowledge reduced to mathematical certainty and precision?"—"If we examine mathematics in an intellectual point of view, there appears to be something of a mechanical turn in the acquisition of its truths; and it is by no means evident, that to excel in mathematical investigation, the more lofty and elevated of our mental powers are required to be brought into exercise. There is a fact, besides, established by the history of philosophy in all ages and countries, which pointedly bears out this opinion, namely, that we have daily instances of persons making themselves proficients in mathematical science at a very early age; but we never find that a person becomes eminent in mental, moral, or political philosophy, till more advanced in life. This is a fact founded upon the natural course of the human mind, and clearly teaches us, that higher qualities of intellect are required to reason upon and comprehend questions on topics relating to human affairs, than are necessary in the solution of problems connected with the pure sciences."—[Blakey's System of Logic. 1834.]

There is another very important topic connected with this subject, which is, the hurtful influence which mathematical studies, or rather, which a taste for the abstract mathematical method, has had on general reasoning, and on the tone and manner in which investigations into things in general have been conducted—a taste, which, taking its origin in the mathematical predilections which succeed the downfall of the old scholastic methods, has, from the ease and convenience which it affords, for taking determinate but narrow and contracted views of things, and the flattering but fallacious assurances it fosters of clearness, decision, and certainty, infected the universal mind, and marred the philosophy of the age. The length of this article, already too extended for a single communication, precludes me from appending my observations on this topic; but they may, probably, form the subject of another letter, if you are of opinion, Mr. Editor, that such matters are not foreign to the scope and objects embraced by your highly useful and valuable miscellany.

I am, sir, yours, &c.

BENJ. CHEVERTON.

TRANSPORTATION OF PERIODICALS.—The transportation of periodicals, recommended in a late number of the Tracts and Lyceum, has not been rightly understood by the "Advocate of Science." The plan proposed that a cheap system of conveying periodicals should be adopted, to be employed by those who wish to avail themselves of it, while others, who chose a more rapid and expensive conveyance, might still take advantage of the mails. The Advocate of Science complains of the hardships of the "honorable fraternity" of printers and publishers. I complain for them too. The law of the United States provides that their manufactures shall be carried only by public lines of conveyance, at the cost of 15, 25, or 50 cents per pound. What if a law should be passed establishing a system of transportation for the articles of the tin-shop or the bake-house, and charging the same rates of freight? Would not the bakers and tinmen complain? Would not the law be deemed an intolerable grievance? Why should booksellers, printers, and publishers, alone be limited to a public system of conveyance for their manufactures and articles of sale? The system of mails was first adapted to a very different state of society from that which now exists. When it originated, there was scarcely any occasion for the conveyance of pamphlets and magazines; and so trifling was the intercourse between different parts of our country, and so expensive was it also, that the mails needed all the support that was to be derived from the transportation of periodicals. But a remarkable change has taken place; and the increase of the transportation of periodicals, both light and solid, ephemeral and annual, is now more rapid than ever; and therefore it is absurd to keep up in an institution a provision not adapted to the times.

But what will be the bearing of a cheap

transportation of printed paper upon the interests of publishers and all connected with them? It would greatly increase their business and their profits. It would operate like the removal of a duty of 25 or 50 per cent. on their manufactures. If postage makes a periodical cost four dollars that would otherwise cost but three, the fewer persons take it. The postage now induces some to take a periodical in their vicinity, when, if the cost of transportation were the same, they would take a foreign publication. But if a publisher gets subscribers in his own town and immediate vicinity, because they have their paper or magazine without postage, he fails to get many subscribers ten, or fifteen, or twenty miles distant, because they must pay the postmaster, in addition to the publisher, one half or one third the first cost of their periodical. I know, by visiting many houses in the country, that not one family in ten takes any magazine, and not more than one in five takes a newspaper. The increase of periodicals would be very great if the transportation of them were more cheap.

The Advocate of Science objects to the slow progress of cheap locomotives, "that our Monthlies, Quarterlies, and Annuals, would be months, and quarters, and years, in reaching their destination." Now, it is one objection to the present system, that such periodicals do not reach their destination *at all*. The Report of the American Bible Society, which I highly prize, I did not get one year till about twelve months after it was printed, and even after I had received the Report of the British and Foreign Bible Society of the same date. In other cases I have never got the first mentioned Report. The mail is too expensive a mode of transporting such publications. But cheap means of conveyance need not be very slow. Over a great part of the route, from one section of the Union to another, however remote, the transportation would have the rapidity of the steamboat or the railroad car, and then would be subject only to land carriage perhaps for fifty miles, to reach the remotest hamlet in the land.

I am no printer, nor editor, but cordially concur with the Advocate of Science, in his views of the intensity of the labors of such men, and of their desert of liberal patronage, while publishing works diffusing useful information and sound morality. They are a class of men who, as society advances, will grow in numbers and respectability; and nothing will conduce more to their success than those means of transportation which will give their productions regular and cheap access to every neighborhood of our country. Such means of transportation are practicable to a great extent. I will refer to a recent fact in proof of this position. A mail is now to go between New-York and Charleston by the steamboat; which, instead of lagging behind the stage at the rate of four miles an hour, will be two or three days in advance of the land mail. Now, there is no need of charging for printing paper 16 or 25 cents per pound freight, when the ordinary freight might be only one cent a pound, and when, at an office of delivery, packages might be distributed almost as cheaply as newspapers, or at most at one cent a pound. Our country is in an extraordinary manner blessed with water communication; and railroads are now rapidly intersecting the country, and will admirably facilitate such a cheap transportation as is here suggested. In such a *state* of things, it is eminently absurd to require by law that periodical literature shall be carried over hills and dragged through mud at an excessive cost, merely to secure a speed for which there is no occasion and no desire.

The system of transportation for packages extended over the whole Union, like the present mail system, would in various ways accommodate the community, promote the diffusion of knowledge, and bind together our common country. F. F.—[Scientific Tracts and Lyceum.]

Improved Apparatus for removing Stone from the Bladder. [From the United States Telegraph.]

I have invented an apparatus for removing the stone from the bladder, without cutting, or scarcely paining the patient. Should you be desirous of seeing my contrivance, I shall have much pleasure in submitting it to your inspection, and explaining the manner of using it. You will see by the apparatus, that I can with the greatest facility, and without any painful sensation to the patient, apply the power of a hundred pounds weight, (and upwards if necessary,) to the body of the stone, for cutting and crumbling it in the bladder. At the same time that I apply this power to the stone, (without withdrawing the apparatus,) I inject into the bladder a fluid that facilitates the *crumbling* of the stone.

With a power much less than what I have stated, I have ascertained that my apparatus will cut and crumble a stone of two inches and a half in its longitudinal diameter, and one inch and a half in its transverse diameter, and this a stone of a harder substance than that of any formed in the bladder, and

in a moistened and comparatively softer state there than when removed from that organ, and dry. A pleasing and interesting peculiarity in a little instrument I have invented, (called a Sound,) for ascertaining if there be a stone in the bladder, is, that if it detects the presence of one, it indicates to me the diameter of it. An interesting little *tell-tale* this, you will perceive it to be, on viewing the apparatus collectively. The *power* I apply to the stone in the bladder for *cutting* it there, or for crumbling it there, is just what I might choose to exert. I can render it with precise accuracy equivalent to any weight, from one pound to a *hundred and upwards*, or retain its action at any intermediate power.

Many other interesting and important particulars connected with the use of my apparatus I must defer an explanation of until you favor me with an interview, then you will have an opportunity of verifying, by ocular observation, what I have stated. I cannot, however, forbear remarking at present, that you will perceive by the apparatus I shall not require any other assistant in performing the operation than the patient himself; and we will not doubt that he would cheerfully assist me in removing from his bladder, (without cutting or scarcely paining him,) a stone that might have been nearly half as big as his fist.

I am, sir, your obedient humble servant,

JAMES LEE HANNAH, M. D.

MODE OF PURIFYING PALM OIL.—*To purify Palm Oil, and to whiten it comparatively for making soap.* Take two parts of quick lime and three parts of the muriate of ammonia, the lime having been previously slacked with half its weight of water, and allowed to cool and reduced to a fine powder, and the muriate of ammonia having also been reduced to a fine powder, and then intimately blended with the powdered lime. The mixture is to be put into a still, or cast iron pan, having a close cover to it, and a tube leading from the head of the pan, or still, to near the bottom of the soap copper, which should contain equal quantities of water and palm oil. On fire being applied to the still, the ammoniacal gas will pass over into the soap copper; and as the water and oil combine, continue adding boiling water to the extent of treble the weight of palm oil in all. By this process the color of the palm oil will be almost instantaneously changed to a pale yellow. The boiling palm oil and water should, of course, be kept rapidly stirring while the gas is passing through. The ammonia, being an alkali, adds to the strength and detergency of the soap, while the peculiar smell imparted by it is so weak as scarcely to be susceptible after a few days' exposure to the atmosphere. —[London Mech. Mag.]

On the Location of Railroad Curvatures; being an Investigation of all the Principal Formulas which are required for Field Operations, in laying Curves and Tangent Lines, to pass through Given Points. By J. S. VAN DE GRAAFF. [From the American Railroad Journal.]

(Continued from page 175.)

14. Let the modulus of curvature be given from which a circular arc is traced in the field with a given chain; it is then proposed to determine the radius of the arc described.

It is very obvious that when n is made variable in (VII.), the *maximum* value of x will express the required radius; but when x is a *maximum*, it follows that Sin. $2nT$ must be a maximum also, if it be supposed that Sin. T remains constant. Now, the quantity Sin. $2nT$ obtains its *maximum* value when $2nT = 90°$; in which case Sin. $2nT = 1$. Hence, denoting the radius of the described circle, *in chains*, by R, the result is,

$$R = \frac{1}{2 \text{ Sin. } T}. \qquad \text{(VIII.)}$$

The most simple formula which can possibly be obtained to express the radius of curvature may be had by means of the cosecant of the angle T. For by the principles of trigonometry, $\text{Cosec. } T = \frac{1}{\text{Sin. } T}$; and consequently (VIII.) becomes,

$$R = \frac{1}{2} \text{ Cosec. } T. \qquad \text{(IX.)}$$

To save the trouble of computation, the following table is here subjoined:

T	R	T	R	T	R
0°. 3′	572.96	1°. 3′	27.28	2°. 3′	13.96
6′	286.48	6′	26.05	6′	13.65
9′	190.99	9′	24.91	9′	13.33
12′	143.24	12′	23.88	12′	13.03
15′	114.59	15′	22.92	15′	12.74
18′	95.49	18′	22.04	18′	12.46
21′	81.85	21′	21.22	21′	12.19
24′	71.62	24′	20.47	24′	11.94
27′	63.66	27′	19.76	27′	11.70
30′	57.30	30′	19.10	30′	11.46
33′	52.09	33′	18.49	33′	11.24
36′	47.75	36′	17.91	36′	11.02
39′	44.07	39′	17.37	39′	10.81
42′	40.93	42′	16.85	42′	10.61
45′	38.20	45′	16.37	45′	10.42
48′	35.81	48′	15.92	48′	10.24
51′	33.70	51′	15.49	51′	10.06
54′	31.83	54′	15.08	54′	9.88
57′	30.16	57′	14.69	57′	9.72
1°. 0′	28.65	2°. 0′	14.33	3°. 0′	9.55

For an application of the above table to an example, suppose it be required to determine

the radius corresponding to a modulus of curvature of 1°, as in the last numerical example. Looking in the column marked R, and opposite to 1° in the column marked T, I find 28.65, which is therefore the radius in chains; and if the modulus of curvature, 1°, appertains to a chain whose length is 100 feet, then the radius of the arc described will be 2865 feet. But if the modulus of curvature, 1°, has reference to a chain whose length is only 50 feet, then the curve traced will have a radius of only the half of 2865 feet.

15. It appears from (VIII.) that the radius of curvature is directly as the length of the chain, and inversely as the sine of the modulus of curvature. Hence, if the radius of curvature be given, then the length of the chain will be directly proportional to the sine of the modulus of curvature. If therefore a curve be traced from a given modulus T, and with a chain whose length is unity, and it be required to find what modulus will trace the same curve with a *chord* whose length in chains is p, let the required modulus be denoted by T′, and we have the proportion $1 : p :: \text{Sin. } T : \text{Sin. } T'$; from which is obtained the formula,

$$\text{Sin. } T' = p \times \text{Sin. } T. \qquad \text{(X.)}$$

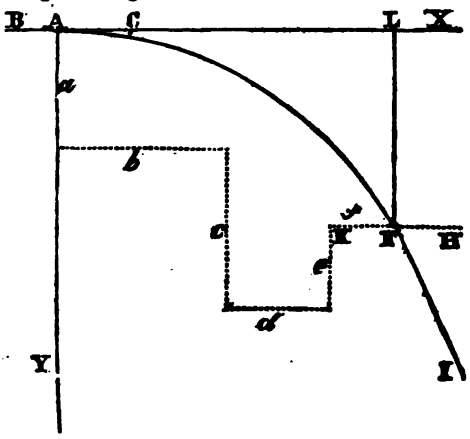
Example. Suppose the length of the chain to be 100 feet, and let it be required to determine the modulus of curvature which will trace a curve whose radius is 10743 feet, by taking chords whose lengths are 10 chains each. Here the radius of curvature is 107.43 chains; and by inspecting the table of radii, given in the last article, I find that the radius 107.43 is situated between the moduli, 0° 15′, and 0° 18′; and therefore, by proportional parts, I find the true modulus which corresponds to the radius 107.43 to be 0° 16′, and which would, consequently, trace the proposed curve with the given chain.

Hence, $\text{Sin. } T' = 10 \times \text{Sin. } 0° 16' = 10 \times .00465 = .0465$; and by the table of natural sines, I therefore find $T' = 2° 40'$, which is the modulus required.

In all cases where the angle T′ does not exceed two or three degrees, the result obtained from (X.) will not differ, by any material quantity, from that obtained agreeably to the principle given in Article 5.

16. Take a system of rectangular co-ordinate axes, having their origin at a given station in a tangent line, from which a certain required curve is to be laid, passing through a point designated by the co-ordinates x, y; the given tangent line coinciding with the axis of x. Parallel respectively to each of the co-ordinate axes, let any number of rectangular lines be traced from the origin, and terminating in the point designated for the required curve to meet; these rectangular lines being selected in any convenient manner to pass any obstacle which may happen to occur. Let the algebraic sums of each of those rectangular lines be taken, agreeably to the axis to which they are respectively parallel. Those sums will obviously give the values of the co-ordinates x, y; and from thence it is proposed to determine a formula, expressing the value of the modulus of curvature of the required curve. And it is also required, from the same data, to determine a method by means of which the instrument may be immediately directed into the true tangent at the designated point x y.

Let AX represent the given tangent line, A the given origin, and AX, AY, the co-ordinate



axes. Take F for the given point, designated by the co-ordinates $AL = x$, and $LF = y$; and let the lines marked with the small letters, a, b, c, d, &c. denote the rectangular lines, originating at A, and terminating at F, and traced in any arbitrary manner parallel respectively to each co-ordinate axis. The algebraic sums of those lines give

$$x = b + d + f$$
$$y = a + c - e.$$

It will in all cases be more convenient to determine the values of x and y, agreeably to the method here proposed, than to trace the lines AL and LF in a direct manner, even if the latter were always practicable. Very often, however, the three, a, b, c, will be sufficient.

The values of the co-ordinates x, y, having now been determined, the next object is to find the necessary modulus of curvature which will trace a curve from the origin at A, passing the point F. For this purpose let each of the expressions (VII.) be squared,* and let the last of the two be divided by the sum of the squares; the result is,

$$\text{Sin. } T = \frac{y}{x^2 + y^2} \qquad \text{(XI.)}$$

The formula thus obtained is remarkably simple, and convenient for use; and it may perhaps be well to observe, that the *safest* method of recording the lines a, b, c, &c., in the field, will be to take on a piece of paper the form $\left\{\begin{matrix} x = \\ y = \end{matrix}\right\}$, and then record each line in its proper equation, and with its proper *sign*, immediately as their values are determined. Example: A system of rectangular lines having been traced to a designated point,

* See note. Art. 20.

let the resulting equations be $\left\{\begin{matrix} x = 20 - 2 + 4 \\ y = 8 + 3 + 1. \end{matrix}\right.$ In this case, then, $x = 22$ chains, and $y = 12$ chains, and $\text{Sin. } T = \frac{12}{484+144} = \frac{12}{628} = .01911$; and by the table of natural sines I therefore find, $T = 1° 5\frac{1}{2}'$; which modulus will trace the curve required.

But if the curve AF, as first determined by means of (XI.) should appear to be too abrupt, or if from any other cause it should be considered advisable to commence the curve from a different origin upon the tangent line AX, as for instance at B or C, and still retain the same point F, then the necessary modulus of curvature from the new origin is easily obtained from the former measurements. For taking $\propto$ to denote the distance AB or AC, the new co-ordinates will obviously be $x \pm \propto$, and y; and consequently upon the same principle as in (XI.), the required formula for the new modulus is,

$$\text{Sin. } T' = \frac{y}{x \pm \propto)^2 + y^2}. \qquad \text{(XII.)}$$

If, for example, the curve last considered had been commenced 3 chains *back* upon the tangent line AX, as at the point B, then the co-ordinates would have been $x + \propto = 25$, and $y = 12$; and, therefore, $\text{Sin. } T' = \frac{12}{625 + 144} = .01561$; or, $T' = 0° 53\frac{1}{4}'$; which is the modulus required to trace a curve from the new origin at B, through the point F.

The direction of the tangent will now be considered. It is very evident that the two curves considered in the two last examples will have very different directions in passing the point F; and it is a matter of considerable importance in the field, after the rectangular lines *a*, *b*, *c*, &c., have been traced to any proposed point, to be able to examine, by the direction of the instrument, what the direction of the curve would be passing from the origin through that given point. Indeed, in different situations, a curve cannot be selected without such a datum; and if the rectangular lines, *a*, *b*, *c*, &c. were not sufficient to furnish that datum with facility, a curve would have to be actually laid upon the ground in order to judge of its fitness, even if we knew a point F through which it would pass. A formula for this purpose is however easily obtained from the rectangular lines *a*, *b*, *c*, &c. Let FI represent a tangent from the point F; there would then, evidently, be no difficulty in directing the instrument, when placed at F, into the position FI, if we knew the inclination of that tangent to the original tangent AX, at the origin. For supposing KF to be the last rectangular line traced, it will, of course, be either parallel to AX, or perpendicular to it; and in *either case* it furnishes the means of directing the instrument into the line FH, parallel to the original tangent at the origin. We have then only to deflect the angle HFI, equal to the inclination of the two tangents, when that inclination is known, and the direction of the curve at F may then be seen at once, from the position of the instrument, without that delay which would be occasioned by actually tracing a curve upon the ground, which would ultimately have to be relaid.

The result therefore is, that a formula must be investigated, expressing the inclination of the two tangents, in terms of the given co-ordinates x, y. Take D to denote the inclination required; then by (IV.), $D = 2nT$; and therefore by (VII.), $x = \frac{\text{Sin. D}}{2\,\text{Sin. T}'}$, and, $y = \frac{1 - \text{Cos. D}}{2\,\text{Sin. T}}$.

Hence $\frac{\text{Sin. D}}{x} = \frac{1 - \text{Cos. D}}{y}$; or, $\frac{\text{Sin. D}}{1 - \text{Cos. D}} = \frac{x}{y}$.

Now, substituting for $\frac{\text{Sin. D}}{1 - \text{Cos. D}}$, its value Cot. $\frac{1}{2}$D, agreeably to the principles of trigonometry, the following formula is the result,

$$\text{Cot. } \tfrac{1}{2}D = \frac{x}{y}. \qquad \text{(XIII.)}$$

Example 1. Take the same curve which was proposed as an example for (XI.) In this case, then, the co-ordinates are $x = 22$ chains, and $y = 12$ chains; and, therefore, Cot. $\frac{1}{2}D = \frac{22}{12} = 1.83333$; or, by the table of natural cotangents, $\frac{1}{2}D = 28° 36\frac{1}{4}'$; or, $D = 57° 13'$. Hence deflect the angle $HFI = 57° 13'$, and the instrument will then indicate the true direction which the proposed curve would have in passing the point F, if traced from the origin at A, by means of the modulus of curvature before determined.

Example 2. Let the direction of the curve which was proposed as an example for (XII.) be required.

Here the co-ordinates are $x + \propto = 25$, and $y = 12$; and, therefore, Cot. $\frac{1}{2}D = \frac{25}{12} = 2.08333$. Hence, $\frac{1}{2}D = 25° 38\frac{1}{2}'$, or, $D = 51° 17'$; and consequently, in this case, deflect the angle $HFI = 51° 17'$, to obtain the direction required. This curve would therefore intersect the former, at the point F, with an angle of $5° 56'$.

In all cases where both of the angles D and T have to be found, the most convenient method will be to determine the value of D by means of (XIII.), and then compute the value of T from that of D. For by a reference to (IV.) and (VII.), the following theorem will be easily deduced,

$$\text{Sin. } T = \frac{\text{Sin. D}}{2x}. \qquad \text{(XIV.)}$$

17. It is frequently necessary that several points should be designated, through which a curve is required to pass, by means of a change of curvature at each of those points. To illustrate this case, and to show the method of operation which ought to be pursued under such circumstances, take AX, (see fig. last art.,) for the primitive tangent line, and AX, AY, for primitive co-ordinate axes, whose origin is the commencement of the required curve. Trace, parallel to those axes, a system of rectangular lines given by the equations

$$\left\{\begin{matrix} x = a + b + c + \text{&c.} \\ y = d + e + f + \text{&c.} \end{matrix}\right\},$$

and terminating at the *first designated point.* Let the instrument be then placed at that point, and directed into tangent, agreeably to the method explained very fully in the last article. Take this second tangent as the axis of x, for a new system of rectangular co-ordinate axes; and parallel to these new axes, trace a second system of rectangular lines, given by the equations $\left\{\begin{array}{l} x = a'+b'+c'+\&c. \\ y = d'+e'+f'+\&c. \end{array}\right\}$, and terminating at the *second designated point.* Let the instrument be now placed at this second point, and again directed into the proper tangent, by the same means as before. Take this third tangent as the axis of x, for a third system of rectangular co-ordinate axes; and parallel to this second new system of axes, trace a third system of rectangular lines, given by the equations $\left\{\begin{array}{l} x = a''+b''+c''+\&c. \\ y = d''+e''+f''+\&c. \end{array}\right\}$, and terminating at the *third designated point.* Continue this obvious order of proceeding until all equations $\left\{\begin{array}{l} x = \\ y = \end{array}\right\}$ have been obtained for *all the designated points;* and then by means of those equations, and (XIV.), compute all the moduli of curvatures. Returning now with the instrument to the primitive origin at A, let each curve be traced from its proper modulus of curvature, agreeably to the principles explained in Art. 9; and the line will be found to pass through all the designated points.

If proper care be observed in chaining the different systems of rectangular lines by means of which the equations $\left\{\begin{array}{l} x = \\ y = \end{array}\right\}$ have been obtained, there can be no disappointment in the result; and consequently, if the designated points have been judiciously selected, there will very seldom be a necessity of tracing the same part of a line *the second time.* And thus the method of co-ordinate axes, in the hands of an individual to whom that term is familiar, is susceptible of being made one of the most important facilities in the field, as will be further illustrated in subsequent articles.

In tracing the various systems of rectangular lines through the different points which may be designated for a curve, there is a principle of practical convenience which must be here mentioned. I mean the principle of designating such points, for a change of curvature, as will cause each section of the whole curve, between the designated points, to be composed of an *integer number of chains,* when those curves come to be ultimately traced, after their respective moduli of curvatures have been ascertained by the methods which have been already explained. It is indeed necessary, in every case, except where the roadway is perfectly horizontal, to know the length of each of those separate curves, in order to select the designated point judiciously with respect to the *grade*; and this datum must therefore always accompany the levels. When a system of those rectangular lines have been traced to any given point, and the corresponding equations $\left\{\begin{array}{l} x = \\ y = \end{array}\right\}$ have been thus obtained, the distance from the origin to that given point, in a right line, will obviously be truly expressed by $\sqrt{x^2+y^2}$; which is a formula rendered very convenient for use, by means of the table of squares and square roots of numbers, subjoined to this volume. And this quantity may be frequently taken as the length of the intervening curve, by which to compute what the *grade* would be at that given point, and will always furnish an easy method of obtaining the approximate distance necessary in making a proper selection for the *position* of a line as far as the *levels have an influence.* The next object then must be, finally, to designate such a point as near the point fixed by the levels as a desirable curvature will permit, and which will produce a curve, from the origin, containing an *integer* number of chains; but as this last condition is only for convenience in subsequently tracing the curve, it must be done without injury to the line, which is in fact always practicable.

Suppose the first system of rectangular lines to be *terminated* at the first point selected from the nature of the ground. Let $\left\{\begin{array}{l} X = a+b+c \\ Y = d+e+f \end{array}\right\}$ be the resulting equations, and compute the value of T, and the value of a certain angle D″, from the following formulas,

$$\text{Cot. } \tfrac{1}{2} D'' = \frac{X}{Y}$$

$$\text{Sin. } T = \frac{\text{Sin. } D''}{2X} \cdot \quad \text{(XV.)}$$

Having now obtained the values of D″ and T, let a certain quantity, N, be found from the following expression,

$$N = \frac{D''}{2T} \cdot \quad \text{(XVI.)}$$

If, then, N be an integer number, it will express the number of chains in a curve passing from the origin to the point designated by the equations $\left\{\begin{array}{l} X = a+b+c \\ Y = d+e+f \end{array}\right\}$, and the angle D″ will then give the inclination of the new tangent at that point, agreeably to (XIII.); and T will express the modulus of curvature as appears from (XIV.). But if N is not an integer number, take n, the *nearest integer number to it,* and retaining the value of T, compute the corresponding *new co-ordinates* x, y, by means of (VII.)

Finally, let two other rectangular lines $h = x - X$, and $k = y - Y$, be traced from the point producing the equations $\left\{\begin{array}{l} X = a+b+c \\ Y = d+e+f \end{array}\right\}$, and a new point $\left\{\begin{array}{l} x = a+b+c+h \\ y = d+e+f+k \end{array}\right\}$ will be thus obtained, *to which* a curve being traced from the origin, by means of the modulus of curvature T, it will contain the integer number of chains denoted by n.

A Steam Waggon has been built in Massachusetts, to run on common roads. Several trials have proved its efficacy. They intend to endeavor to make it pack and unpack all its packages, and keep its own account of freight.

MANUFACTURES OF IRELAND.—The history of the manufactures of this country is in part a recital of its wrongs. The nature of the soil and climate is in favor of pastoral pursuits. This, in connection with some early restrictive measures, has prevented Ireland from ever extending its manufactures much beyond the wants of the population. As early as the reign of Edward III. a brisk trade was carried on with Italy in woollens, particularly in the Irish caddow, or woollen coverlet. A colony of the Palatines, in the reign of James I., formed their chief settlement at Carrick on Suir, and gave a stimulus to the manufacturing interest, and afforded employment for a large number of the surrounding inhabitants. Even after the prostrating wars of 1641 and 1688, the woollen trade was so flourishing that the jealousy of the British manufacturers was excited to so high a degree, that they procured an address from both houses of Parliament to William III., "to use his utmost diligence to hinder the exportation of woollens from Ireland, except to England, and generally to discourage the woollen manufacture in Ireland." Acts were passed in accordance with this petition. In 1779, however, the prohibition against exporting woollen cloths was repealed, and the trade revived. In 1812 the woollen cloth imported from England amounted in quantity to one third, and in value more than one half of all that was consumed. An existing duty of 8½d. per yard, on all qualities, served as a prohibition of the coarser kinds; and hence the reason why Irish manufactures are confined principally to low priced goods. In 1823 the protecting duties were unexpectedly repealed. This was followed by a great influx of English goods of a newer fashion, and an almost total ruin of Irish manufactures. Those dependent on the factories were reduced to depend on charity, or compelled to emigrate. Most of the woollen manufactories now existing are in the vicinity of Dublin. These produce goods to the amount of £200,000 annually.

The linen manufacture arose in part on the ruins of the woollens. In early times, the Irish gentry were profuse in the quantity of linen used in their inner garments: a shirt of a man of rank contained twenty or thirty yards. Great exertions were made by patriotic individuals to improve this branch of Irish industry, particularly by the Earl of Stafford, who, when Lord Lieutenant, embarked £30,000 of his own fortune, and by the Duke of Ormond. Since their days, the trade has been encouraged by legislative enactments. Among the expedients adopted to promote this manufacture, when in its infancy, the use of linen scarfs and hat bands at funerals was introduced.

Notwithstanding great exertion, Ireland is unable to raise its own flax-seed. That which is produced is of an inferior quality. In 1821 there were imported from

America, - - -	36,176 hhds.	
Prussia, - - -	8,424 "	
Holland, - - -	7,308 "	
Britain, - - -	5,934 "	
		57,842 hhds.

On the revocation of the edict of Nantes, the silk manufacture of Ireland had its origin. Extensive trade was carried on in worsted and mixed silk, but the fluctuation of female fashion caused a decline; and now the silk trade in Ireland is comparatively very limited. In 1825 the Earl of Liverpool, then prime minister, made great exertions to rear the silk worm in the south of Ireland, but the climate was found too chilly and moist. In 1784 the first cotton factory was erected in the neighborhood of Belfast. This trade has been fostered by government, and has increased, while the linen manufacture has necessarily declined. The manufacture of metals is limited, owing to the scarcity of fuel; but that of ardent spirits flourished in spite of severe enactments against illicit distillation. In ten years, ending in 1818, there were 16,244 unlicensed distilleries destroyed, in which 36,965 gallons of spirits, and 47,843 barrels of malt, were seized and destroyed. In the subsequent ten years, there were 41,645 distilleries, 47,843 gallons of spirits, and 156,636 barrels of malt, destroyed. Nothing but the temperance principle has made any material reduction in the use and manufacture of this injurious article.—[N. Y. Farmer.]

STEAM COMMUNICATION WITH INDIA.—The House of Commons' Committee on Steam Communication with India have reported to the House that, in their opinion, the route by the Euphrates and the Persian Gulf is superior to every other proposed, for its "physical, commercial, and political advantages," and they recommend that a grant of £20,000, should be made by Parliament to defray the expense of giving it a fair trial. The distance from Bir, in the Persian Gulf, where this line would commence, to Scanderoon, in the Mediterranean, is stated to be much less than that between Suez and Alexandria. The Committee do not appear to have inquired at all into the merits of the route by the Cape of Good Hope. We are surprised at this, for whatever may be said in favor of either of the Mediterranean routes, as affording a quick, though not always sure, conveyance for letters, we think it is demonstrable that for goods, passengers and troops, the line by the Cape is that on which steam may be employed with the greatest advantage. We alluded some time ago to a pamphlet, by the Messrs. Seward, C. E., in which this view of the subject is very ably advocated, and shall take an early opportunity of bringing it again more particularly under the attention of our readers.—[Lond. Mech. Mag.]

M. DUPIN has been so well pleased with his reception in England, that one of his colleagues, the Duke de Broglio, is about to follow his example, by paying his respects to the Lord Chancellor. Forthwith, of course, he will be taken to the Mechanics' Institution, and made an honorary member. The distinction will not, however, be so appropriately conferred as it was on M. Dupin, whose brother, Baron Chas. Dupin, is well known as the introducer of similar institutions into France.—[Ib.]

THE BLIND MAN'S BIBLE.—We have before us, in a goodly sized quarto volume, the Gospel of St. Mark, printed, or rather embossed, for the use of the blind. This is the first book that has been prepared in this country on this plan. It is the handy work of Mr. SNYDER, the gentleman who acts as secretary of the institution, and is a beautiful illustration, if no fulfilment, of the prophecy, that "the blind shall see." This admirable specimen of the art of embossing letters is worthy the attention of the curious. —[United States Gazette.]

IRON BOAT ON A NEW PRINCIPLE.—Mr. David Napier, engineer, has fitted up an iron boat on a new principle, to sail on the Clyde. A large portion of the boat below the water line is formed into a condenser, and the water outside keeps it cool, so that little (if any) injection water is required. In this plan, the water pumped into the boiler will not be so salt as if more water were let into the condenser; and an air pump a little smaller than ordinary will work the engine.—[James Whitelaw, Glasgow, June 25.]

NEW LOCOMOTIVE ENGINE.—A new locomotive engine, from the foundry of Messrs. Geo. Forrest & Co., was tried on Monday on the railway. It made the journey from Liverpool to Manchester in 67 minutes, and brought back the first class train in 77 minutes. This powerful and rapid engine is intended for the Dublin and Kingstown Railway.—[Liverpool Chronicle, July 28.]

NEW METHOD OF LIGHTING THEATRES.—A new method of diffusing light through a theatre has been discovered by a mechanist at Venice. By the aid of parabolic mirrors the light of many lamps is concentrated over an opening made in the ceiling of the theatre, and reflected downwards on a system of plano-concave lenses of a foot in diameter, which occupy the aperture, and convey into the theatre the rays of light which arrive at them parallel and depart from them divergent. From the pit the lenses are alone perceived, which resemble a glowing furnace; and although the luminous focus is sufficient to light the whole of the theatre, it does not dazzle, and may be viewed without fatiguing the eyes. The apparatus being entirely concealed, accommodates itself readily to all the changes which the representation can require. It likewise occasions neither smoke nor bad odors, and has none of the inconveniences of the old system.—[Morning Post, England.]

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This work is clearly and beautifully printed, as well as correctly, and the paper most excellent. So much for its external and internal appearance has been done, and that so well, that we were fearful the contents might not be in keeping, but on perusal thereof we were more than agreeably disappointed; we were right well pleased. There is a mild gentlemanly tone of criticism, (the suaviter in modo, and yet the fortior in re,) which pervades through its pages; and we are glad to find that the work contains so many reviews, and with such ample extracts. There are very full and able reviews in this number of Guy Rivers, Tutti Frutti, Historical and Descriptive Account of British India, from the most remote period to the present time, Things as they are, and Tales and Sketches such as they are, and short reviews of six other popular works. The review on Foreign Politics is written in a clear and comprehensive manner, which gives good promise of its future quality, as it is to form a continuing standing feature of the Gazette. From the scourge which has visited our city, but which is now nearly abated, the proceedings of the scientific, the galleries of art, the sounds of harmony, and the places of public amusement, being suspended for a time, the editor has been prevented in this number from gratifying his readers with an account thereof. We have no doubt it will be an additional charm to the work, for science, the fine arts, and harmony, afford us the greatest and most intellectual treats, gratifying the mind, the eye, and the ear.

We trust that the expectations of the proprietors, which they have in a well written neat address on the back of the work, will not be disappointed, but that we shall for many years have the weekly pleasure of reading this really very excellent and amusing work. We see no reason why it should not last as long as its prototype, the London Literary Gazette, which has been now published for sixteen years.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum in *advance* —JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

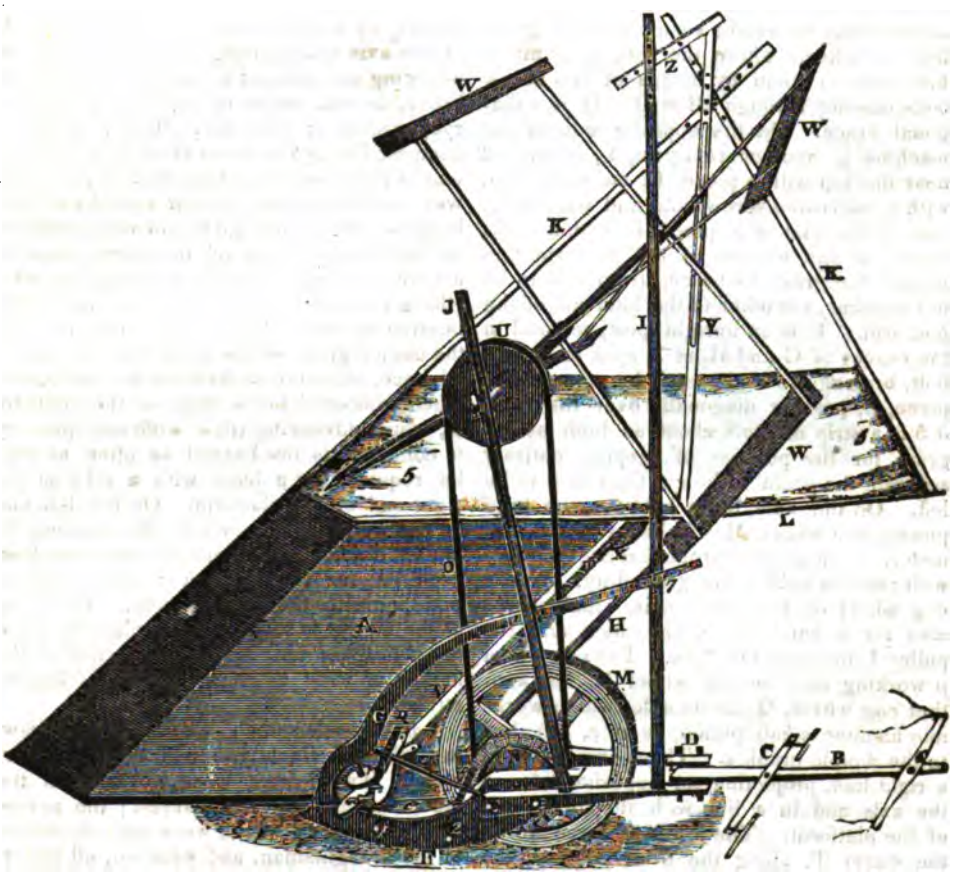
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING OCTOBER 11, 1834. [NUMBER 4.

"It is a strange thing to behold what gross errors and extreme absurdities men do commit for want of a friend to tell them of them. The help of good counsel is that which setteth business straight."—BACON.

CYRUS H. M'CORMICK'S IMPROVED REAPING MACHINE.



To the Editor of the Mechanics' Magazine:

DEAR SIR,—I send you a drawing and description of my Reaping Machine, agreeably to your request.

References—A, the platform; B, tongue; C, cross-bar; D, hinder end of the tongue; *e e*, projections in front; F, broad piece on each side; G, circular brace; H, diagonal brace; I, upright post; J, upright reel post; K, braces to upright; L, projection to regulate the width of swarth; M, main wheel roughened; N, band and cog wheel of 30 teeth; O, band; *p*, small bevel wheel of 9 teeth; Q, do. of 27 teeth; *r*, do. of 9 teeth; *s*, double crank; T, cutter; V, vibrating bar of wood, with bent teeth; U, reel pulley; W, reel; X, wheel of 15 inches diameter; Y, reel post.

The platform A is of plank, made fast to a frame of wood, for receiving the grain when cut, and holding it until enough has been collected for a sheaf, or more. The projections in front, *e e*, are two pieces of the platform frame, extending about 1½ feet in front, and one or more feet apart. On each outside of these pieces is to be secured a broad piece of wood, as at F, by screw bolts, as at 1 1, passing through them and the pro-

jection of the frame. From the end of the outer broad piece, nearest the platform, rises a circular brace, G, projecting forward, and secured to the reel-post, I, by a moveable screw bolt. About nine inches in front of the screw bolts, at 1 1, are two other *moveable* screw bolts, as at 2, passing through both broad pieces and the ends of both projections, allowing for a rise or fall in adjusting the height of cutting; and at about the same distance, further on, is to play an axis of a wheel to be hung between said pieces. Near each end of this axis is secured an arm with two screw bolts, as at 3 3, one of which is moveable, as will be seen; projecting before the wheel, where the tongue is made fast between them by means of two screw bolts passing through all at D. H is a diagonal brace. On the opposite side of the machine is another reel-post, Y, connected near the top with a piece, K, on each side, with a moveable screw bolt, and extending, one to the end of a piece, L, which is attached to the outside of the platform, and divides the grain to be cut, from that to be left standing, the other to the hind end of the platform. T is an upright post, secured to the braces of G and H, at 7, by a moveable bolt, bracing the reel-post Y by means of a piece, Z, passing diagonally over the reel. 5 5 is a strip of cloth about as high as the grain, for the purpose of keeping entirely separate the grain to be cut from that to be left. On the axis, hung between the hind pieces, is a wheel, M, of about two feet diameter, having the circumference curved with teeth to hold to the ground by. N is a cog wheel on the same axis, which serves also for a band wheel, on which and the pulley U the band O works. The cog wheel *p* working into the cog wheel N, has another cog wheel, Q, on its axle, which works into another small pinion, as at *r*, attached to the double crank *s*. These cranks are in a right line, projecting on opposite sides of the axis and in a line with the front edge of the platform. The lower of these works the cutter T, along the front edge of the platform, and the upper one the vibrating bar V, counter to each other. The cutter is a long blade of steel, with an edge like that of a reap-hook, and is supported on the under side by stationary pieces of wood at suitable distances apart. This blade is attached to the frame piece, below the edge of the platform, by means of moveable tongues or slips of metal; the bolt securing it to said frame-piece acting as a pivot, and that through the blade likewise, so that the motion is described in part of a circle. The vibrating bar is of wood, of the same length, and secured in the same manner, above the cutter, with iron teeth made fast in it, at about 2 inches apart, extending before the edge of the cutter, and bent round under it. This vibrating bar has been and may be made stationary, with bent teeth supporting the stalks on each side of the cutter, thereby dispensing with the upper crank; but the other is much preferable, as it reduces the friction and liability to wear materially, by dividing the motion necessary for one between the two, and counterbalancing each other.

In the upper end of each reel-post is a groove, or long mortice, to receive the end of the axis of the reel, which rests on an adjusting pin, subject to be moved higher or lower, to suit grain of different heights—rye, wheat, or oats, &c. The reel W is composed of two or more cross arms at each end of the axle, projecting about 3 feet each way, and connected at their ends by a thin board of about nine inches in width, which, by the arrangement of the arms, runs in a somewhat spiral direction along the axis (though it might be parallel), the right end bearing up first on the grain. This reel, by the motion given by the strap O as the horses advance, bears the stalks upon the cutter, and when separated lands them on the platform A, which advancing till a sufficient quantity is collected, is discharged as often as may be required by a hand with a rake at the right end of the platform. On the left end of the platform is a wheel, H, of about 15 inches diameter, that may be raised or lowered as the cutting may require, corresponding with the opposite side. The point of the tongue is secured to its place by passing through a pin, 6, that is fastened to the hames of each horse by means of leather straps.

I have made some alterations on the drawing, which I think you will readily understand. Two horses were not used to the machine until the last harvest; the necessary changes of which were only described to the draughtsman, and were not all understood. I directed that it should not exceed 5¼ inches, though I think it does one way. The wheel H I think has a wrong direction.

Very respectfully, yours, &c.

C. H. M'CORMICK.

Improvement of the Barometer.

[From the American Journal of Science and Art.]

To Prof. SILLIMAN:

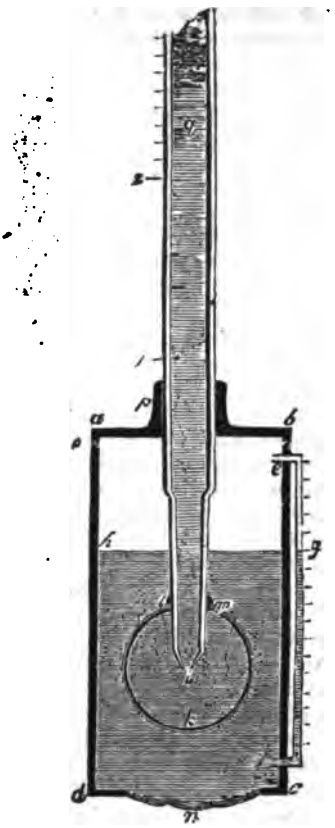
Dear Sir,—In the frequent use of the portable barometer, I have often experienced much inconvenience from air entering the

tube, at times when perhaps great precision was necessary, not only for ascertaining the altitude, but likewise for weighing the atmosphere, which is sometimes intimately connected with other experiments, then under a course of investigation.

Although one of the most simple in form, the barometer is probably one of the most difficult instruments to *construct*. The frequent breaking of the tubes, while undergoing the great heat which is necessary to exhaust the air, requires more patient care for this tedious process than most men are able or willing to devote; and yet, without this process, and that well and effectually performed, the air must be diffused through the mercurial column, or escape to the top, where it destroys the vacuum, in which case the instrument is not suitable for the purpose intended, and does not deserve the name of barometer. The manufacturer who would allow such an instrument to pass from his hands to the world, is guilty of a great misdemeanor, and deserves the censure of all good men; for such imperfections have prevented the barometer from attaining the rank which it deserves in the estimation of the world. It is an insult to the memory of *Torricelli*, who will yet be ranked among the greatest benefactors of mankind.

It is to be regretted that so many imperfect or deranged instruments are in use. It destroys all confidence in the barometer, and I know some persons who *deride* its well known properties of predicting winds, and even treat the idea as *chimerical*. But such men could not have possessed a perfect instrument, or have devoted a proper attention to the observations, as thousands can testify to its efficient warnings; when, by suitable and timely preparations for the predicted hurricane, property and lives have been saved from the devastating elements, which would otherwise have involved the whole in ruin.

Although in the construction and repairing of my barometer I was generally fortunate in clearing the tube entirely of air, yet, in use, I think I never kept it one year in that perfect condition. This repeated derangement and consequent expenditure of time, patience, and money, led me first to inquire the cause, which I soon learned, and then undertook to invent something which should effectually prevent the evil. I soon succeeded, even beyond my most sanguine expectations, so as even to render the instrument perfectly secure against all accidents, except breaking, to which *all* instruments are subject. With this security I have not encumbered the barometer with any thing on the outside, but the whole is confined to the



cistern, thereby retaining the instrument in the most *portable* form.

The annexed engraving represents a vertical half section of the barometer. *a b c* and *d* is the cistern, two inches long and one inch in diameter. *e* and *f* is a glass tube, open at both ends, and let into the cistern above and below zero, which in the barometer is always changing its position. The original zero is marked on this tube at *g*, with decimal parts of the inch, extending above and below, to be deducted from, or added to, the height of the mercurial column in the large tube. *h* is zero, which, when made on a level with the ocean, stood ¾ of an inch from the top of the cistern, which immerses the top of the globe ¾ of an inch in mercury. The ¾ of an inch between original zero and the top of the cistern, leaves sufficient space for the column, in high altitudes, to fall: a circumstance which has never been properly attended to in constructing barometers; although probably no other barometer will admit of so much space, without endangering the instrument. *i* is the end of the tube, with the column drawn to a small point, which answers precisely the same pur-

pose as the contraction in M. Gay Lussac's "improved marine portable barometer." But in this case the contraction at the bottom of the tube possesses other advantages than merely to prevent the sudden rise and fall of the mercury; for by placing the contraction at the bottom, we can draw the end of the tube to a small point, which renders the column less liable to admit air, either from a concussion or inverting its position.

This improvement alone I deemed of sufficient importance to justify the *construction* of a new barometer, and was actually prosecuting it, when an idea of the *globe* suggested itself to me.

In all the portable barometers that I have seen, the end of the tube is cut or broken off in a careless manner, which as often leaves it *concave* as *convex*, and it must be apparent to every one who will examine the subject, that bubbles of air striking the *concave* end of a straight tube are more likely to enter the column than to roll off.

k is the *globe*, ½ of an inch in diameter, fixed firmly on the tube at *l*, and has a very small aperture at *m*, the only place where the mercury inside can communicate with that in the cistern. The globe is of cast steel, with which mercury is known to come in *perfect contact;* consequently the atmospheric pressure *cannot* force the air through this aperture, nor through the bottom of the tube. By examining this arrangement, you will perceive the impracticability of even *forcing* the atmosphere through the globe, much less the possibility of its being driven there by inverting and re-inverting the instrument, or by any jar or concussion which it may receive while in use or being transported.

Even admitting air to be *placed* in the globe, it is apparent that it would find its way out by the aperture one hundred times oftener than it could possibly enter the tube.

s is the leather bag through which the atmosphere communicates its influence to the whole interior of the cistern and column. Leather is the most in use, although there are other methods to admit the atmospheric pressure, in forms of the instrument, which are perhaps not so portable; although, for general use, a short tube, with a stop-cock or plug inserted in the top of the cistern, is probably the best.

o represents a screw joint of the cistern, where it is separated while attaching the globe to the tube; for the tube being connected with the cistern at *p*, would render it impracticable to fasten the globe without this separation. I mention these minutiæ, because those who undertake to make a barometer on this plan may otherwise be subject to the same perplexities which I experienced in the construction of mine.

I did not succeed in obtaining a globe, until the *third* person made the attempt, and produced it from a solid piece of steel. If made in *two* parts, it would necessarily be joined with solder, on which the mercury would act too powerfully.

The screw joint at *o* may appear simple and useless, but the *want* of it occasioned a delay of many days, and caused the breaking of several tubes, while trying to fasten the globe. The person employed on this part, twice threatened to abandon the work as impracticable, when fortunately the idea occurred to me of disconnecting the cistern in that part to afford ample space to work at *p*.

q is the mercurial column, ¼ of an inch in diameter, except the part inside of the cistern, which is diminished in order to leave the more vacant space for the column to fall in high altitudes, and likewise to lessen the large orifice in the globe through which the tube enters.

Other proportions than those here given may serve equally well to construct a barometer on this principle, but these are the dimensions of the one which I have now completed, and for distinction will call the *Globe Portable Barometer*. It has been inspected by several scientific gentlemen, who, with my request, exposed it to all the causes which usually derange barometers, such as jarring, shaking, concussions, inverting and re-inverting its positions, without causing the least perceptible derangement. I invite all, who are so inclined, to call and see it; and to those who desire to make one, I will cheerfully give any information in my power to aid them in its construction.

Since the invention of the barometer by Torricelli, many learned men have devoted their attention to the improvement of this valuable instrument, and among the most useful is probably M. Gay Lussac's "*Improved Marine Portable Barometer*," wherein, at a certain point, the column of mercury is contracted to prevent the sudden rise and fall of the mercury by the undulating motion of the ship, while the remainder of the column retains sufficient diameter to avoid a very sensible effect from the temperature of the atmosphere. But this, as well as other forms of the barometer, whether secured by the screw and cushion pressing on the bottom, or by the stop-cock as employed by Mr. J. F. Daniels, is liable, by sudden turning or concussion, to admit air into the tube; for although the cushion and

stop-cock renders the instrument *portable*, it never can be *employed* as a barometer, until the entire column is open from the hermetical seal to the cistern or atmosphere below. It is in this situation, (the only one of practical use,) that the instrument is deranged. *First*, by suddenly inverting and re-inverting the position, so that, (while passing from the bottom to the top of the cistern,) the air strikes the end of the mercurial column, and must rise in the tube, because it is lighter. *Secondly*, by a concussion which it receives every few minutes while in use, either from the motion of the ship, the carriage, the shrubbery on a mountain, or the unavoidable contact with the car and cords in a balloon; for by observing the mercury in a glass cistern, you will perceive that a concussion causes a motion like the sea waves, which mounting on one side frequently leaves the end of the tube exposed to the atmosphere, which here strikes the base of the column, and rises in the tube by its comparative weight. *Thirdly*, it is asserted that the barometer, in a course of years, will have accumulated air above the column, even if during all that time it should have been suspended in a room, without any jar or concussion to communicate the least motion; and the two most probable causes assigned are, first that the air enters through the pores of the tube, and secondly, that mercury never comes into perfect contact with glass; the latter is the most probable cause, from which it is inferred that the air in the cistern is by the atmospheric pressure forced down in extremely minute particles between the mercury and the tube, where it acquires the additional impetus of its own comparative specific gravity, and rises between the mercury and internal surface of the tube to the top of the column. As a preventive to the latter derangement, it has been suggested, and I believe practised by some, to fit closely on the bottom of the tube a ring of platina, or any other substance with which mercury comes in perfect contact, although without sufficient action to cause, for years, any perceptible diminution.

From the important purposes to which the barometer is adapted, it may well be supposed to have enlisted the attention of the most scientific men in all countries, and, indeed, for some of its uses it is invaluable, and probably no instrument will ever be invented with any proportion of its combined properties. For although by a number of instruments we can weigh the atmospheric pressure, yet even if the instruments would give the precise weight, the time occupied to obtain the result would render useless the object for which the trial was made, as the wind or calm would have actually arrived which was predicted by the state of the atmosphere when the barometrical observation was made.

A gentleman commanding one of the New-York and Havre packets, for whose scientific knowledge I entertain a high regard, told me, "that when the ship was moving with much velocity, even the barometer could not indicate the current of air," for, said he, "the ship will have moved beyond the influence of the wind, which was indicated when the barometrical observation was taken." The remark is worthy of consideration, and the want of a due attention to it is probably one of the causes which has aided to retard the more general use of this instrument among mariners. But by far the greatest cause which has prevented the universal use of the barometer, is the difficulty of procuring a good one, and the still greater difficulty of retaining it in perfect condition. It is not always easy to procure a workman competent to construct one, and when such a man is found, he is not able to devote that attention which is necessary to its adjustment, and to the boiling of the mercury in the tube, lest he should not meet the views of his customers, who are in the habit of purchasing at too low a price.

We may measure mountains by observed angles, but those who have tried the various methods give a decided preference to the barometer, which, in some cases, is the only instrument by which we can ascertain their altitude. For the cyanometer never can be used with accuracy, while sight differs with different men, or while the coloring matters for the blue tints differ so much in consequence of the soil or matter which produce them, and are so subject to change by exposure to the various climates. In the account of his travels and philosophic researches, Baron Humboldt has in many instances given us the degrees exhibited by the cyanometer, but for any satisfaction to the world, or benefit to science, he may as well have spared himself that trouble, for allowing all men to see alike, who, on being told that the cyanometer exhibited 10 or 60, has any conception of the height? We have nothing to which we can refer for accurate comparison, either impressions on the brain, or unalterable blue colors portrayed in cyanometrical form.

Being at Paris in July, 1828, I applied to some of the most reputable philosophical instrument makers for a cyanometer, but not one of them had any knowledge of it, or even knew there was such an instrument. I then

called on Messrs. Gay Lussac, Cuvier, and Biot, for information respecting it. The last named gentleman was absent from the capital, which deprived me of the pleasure and information I should have derived from a conversation with him. M. Gay Lussac told me, "that he considered the instrument of very little utility, and that it was found only in the works of M. Saussure, a young gentleman of extensive scientific acquirements, who with an inventive genius combined an untiring zeal for knowledge. He travelled extensively, and it was during his passage over the Alps, where, from the blue color of the heavens, an idea occurred to him of constructing an instrument with degrees and altitudes marked to each of the blue shades, which should correspond to those in the heavens." And, continued the sage philosopher, "Saussure is dead, and those only who have been at great heights, and retain a recollection of the color, are capable of making a cyanometer."

With the information I derived from him, and my subsequent experience of these colors, I constructed such an instrument; and after repeated trials, comparing it with the barometer, at various altitudes, I found it could not be relied on for accuracy.

Many men who have devoted their attention to the subject I believe are convinced, that both the cold and darkness increase as we recede from the earth; and I have no hesitation in saying, that beyond the earth's atmosphere it is as much darker than night as any thing we can conceive; and although this darkness may increase in regular progression from the earth, still, from causes before related, I do not believe that any instrument can be found as a substitute for the barometer in measuring high altitudes.

At my fifth ascent with a balloon, from New-York, in May, 1833, I was compelled, in consequence of a high wind which prevailed, to unmoor without any philosophical instruments, except the cyanometer, which I had fortunately placed in my pocket-book. From causes which were stated in the public journals, the balloon was uncontrollable for some minutes, (a part of which time it was ascending with nearly the rapidity of an arrow,) although immediately on leaving the earth I opened the valve, which is near the top, and through which the gas would soon have escaped, but for the rapid upward motion, which caused so much resistance or pressure from the atmosphere as to retard the escape of the gas until thirty or forty minutes, when the aerostat was poised in air, and I had reached a greater altitude than I have before or since attained. Here for the last time I tried the cyanometer, which, for any utility, I might as well have left below with the barometer. The heavens were many shades darker than the blue tints to which I had affixed an approximate degree and altitude on my cyanometer, and so uncertain is sight, that when I had selected a corresponding shade on the cyanometer, in one instant the heavens would appear too light and the next moment too dark. I resolved then to abandon all further experiments with an instrument which promised to be of so little use; and if it was not to confirm M. Gay Lussac's remarks, and prove the superiority of the barometer, I should not have considered the experiments with the cyanometer worth communicating to the world.

I am aware that, among scientific men, there is an unbelief of the fact that *intensity of darkness increases as we recede from the earth*, but I do not consider it my duty here to enter upon a proof of the assertion, or attempt to explain the cause which produced it. I should infringe on your pages with a work which I do not feel competent to perform, and will leave that for more able pens than mine. The world may expect to have soon a rich intellectual treat on that subject from a gentleman in Baltimore, whose scientific acquirements, added to his profound reasonings and lucid mind, I am satisfied, (from personal acquaintance,) render him in all respects competent to perform the task.

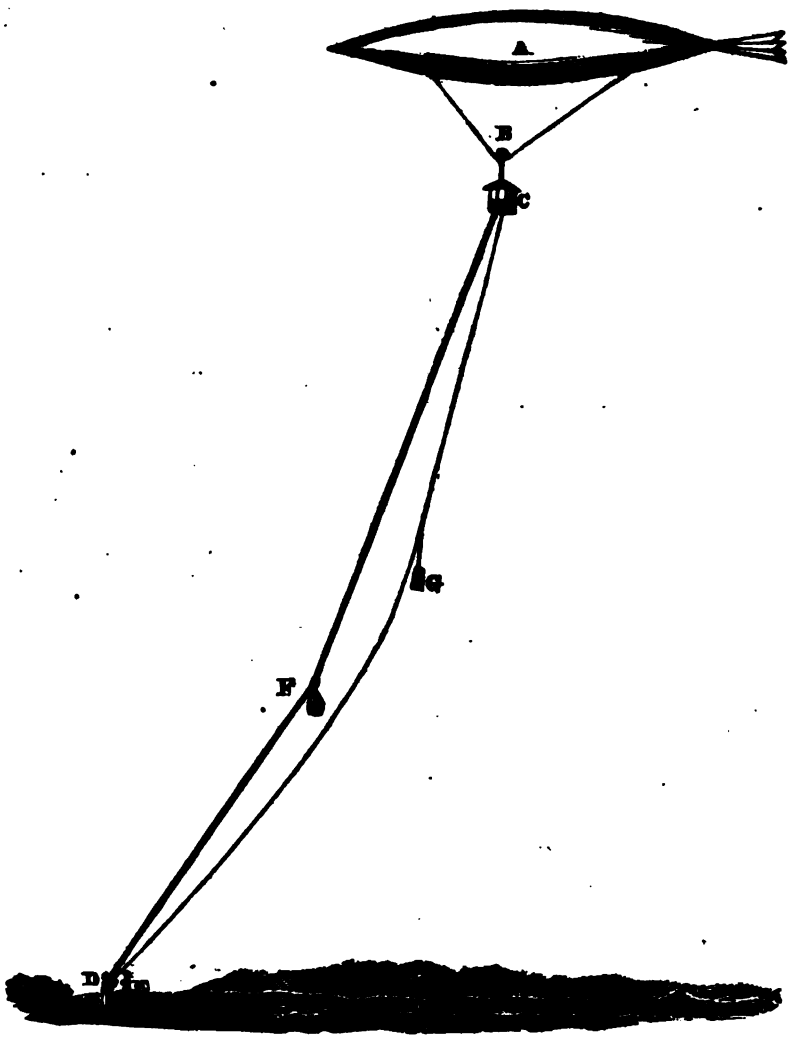
My object in this communication is to explain the principles of my improvement in the barometer, to point out its *advantages* over all others, and induce the world, through your widely circulating Journal, to use the *globe* in all cases where the instrument is required to be *portable*. If science can be improved, and mankind receive a benefit from this effort, if will afford me much pleasure to have contributed a mite to so noble a cause. CHAS. F. DURANT.

Jersey City, 18th July, 1834.

Plan for an Observatory Balloon.

To the Editor of the Mechanics' Magazine.

SIR,—Much curiosity having been lately excited in various places, and much attention drawn to the subject, by the ascension of various balloons, I shall propose a plan by which the same principle may be applied to a more useful purpose than a mere exhibition of the buoyant power of hydrogen gas in atmospheric air. This buoyancy, it is well known, is something more than one ounce to every cubic foot. A balloon in the form of a pointed spheroid, 125 feet long,



References—A, the balloon; B, the pulley to which the ladder is attached; C, the saloon, with a person looking out, D, a post, to which the balloon is moored; E, a man turning a crank, by which the car F is made to ascend; G, a weight used as a counterpoise to the car, &c.

and 25 feet in diameter, would contain about 30,000 cubic feet, the buoyancy of which would be about 1900 pounds avoirdupois. For constructing such a balloon, 500 yards of sheeting would be required, which, when varnished, or made water-proof by gum elastic, would weigh about 500 pounds. Eight rods of wood, to be used in the construction, for the purpose of keeping the balloon in proper shape, and extending the whole length, would weigh 200 pounds. Add to this 400 pounds of cordage, for constructing a rope ladder whereby to moor the balloon to some object on the earth, and 100 pounds for a saloon to be attached to the ladder near the top, there will yet remain a balance of buoyancy of 700 pounds.

A vane, or rather a tail, constructed of some light material, may be attached to one end or point of the balloon, which will keep it invariably pointed in the direction of the wind.

I have ascertained by some recent experiments, that the force or pressure of a wind that travels 35 miles in an hour, (which is a gale,) is about ten pounds on every square foot of canvas, placed at right angles with its direction. It also appears from other experiments, (also by calculation,) that a pointed spheroid, whose length is equal to five times its diameter, sustains, when point-

ed to the wind, but one twenty-fifth part of the force that is sustained by the end of a cylinder of the same diameter. Hence we may infer that the pressure of such a gale on a balloon of the above dimensions, the area of the circumference of which is 475 feet, would be only about 190 pounds, exclusive of that on the ladder, &c. This would carry the rope or ladder to an angle of 60 degrees with the horizon. In addition to the rope ladder, a small leather pipe or hose will be required, to extend from the balloon to the ground, for the purpose of supplying the balloon with gas, should any escape. The head of the ladder must not be attached to the balloon, but to a block or pulley, which may move forward or backward occasionally on a rope, the two ends of which are secured to the balloon between the points and the centre, as represented in the engraving; by this arrangement the balloon will have more liberty to retain its horizontal position.

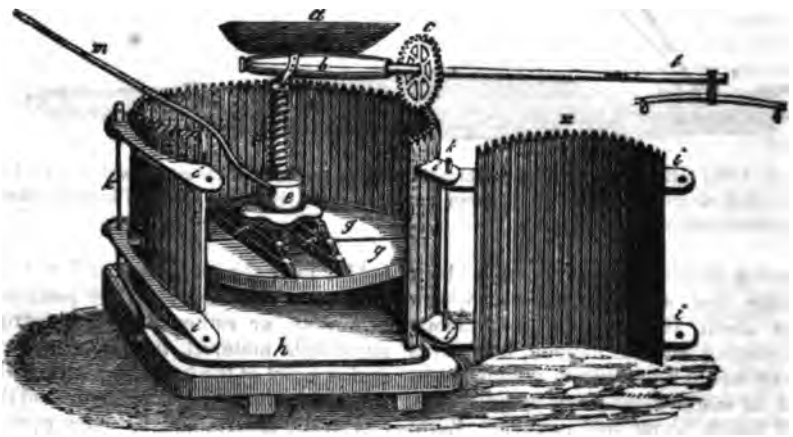
With regard to its utility, if such a balloon be moored in a central part of a large city, a watchman may be stationed alternately at a height sufficient to overlook the city, and not only give a ready alarm in case of fire, but inform the firemen by signals, by night or day, in what street or section of the city their aid is wanted—the watchman being informed, (in case the fire is not visible,) by a signal displayed by any fireman or other person, from the top of the building, or of one adjacent to that on fire. This watchman may also give notice of the approach of vessels, long before they can be seen from an ordinary observatory. It would, moreover, be a gratification of curiosity, but a valuable lesson of information, for any person to take a general view of the city and surrounding scenery from an elevation of a thousand feet; and there can be but little doubt that such a balloon, (which would cost less than a thousand dollars,) would be well supported by the contributions of such visitors. The saloon should be furnished with good glasses, and to avoid the fatigue of climbing, a car, with a convenient seat, may be made to ascend or descend the ladder with passengers, by means of a counterpoise and a slight exertion of the attendant.

I had thought of recommending an electric rod; but considering the nature of the materials of which the balloon is composed, I am confident that lightning will never affect it sufficient to rend or burn the cloth; and it is well known that the gas cannot be ignited except in contact with oxygen or atmospheric air.

In my next I may give some hints on the practicability of propelling and navigating a similar balloon; but for the present shall content myself with subscribing, respectfully yours, R. Porter.

Billerica, Mass., Sept. 5, 1834.

BEECHER'S PORTABLE CIDER MILL AND PRESS.



This machine combines in one the grinding part and the press. It occupies a space of five or six feet square. It is a very economical cider mill. Mr. B. has not yet fully established its merits from practical experiments.

References—*a*, hopper; *b*, grinding apparatus; *c*, cog wheel; *d*, screw of the press; *e*, entrance of the lever; *f*, blocks; *g*, planks for pressing; *h*, bottom of the press; *i*, holes to secure the braces or arms; *k*, rods or pins; *l*, beam to attach the horse; *n*, door to take out the pomace.—[New-York Farmer.]

History of Astronomy—its various Systems, &c. [Continued from page 164.]

MOTIONS OF THE EARTH.—When we consider the apparent diurnal motion of all the celestial bodies, we cannot but recognise the existence of one general cause, which produces this appearance. But when we consider that these bodies are not only at different distances from the earth, but at different distances from each other, and that these distances are not always the same, we shall find it difficult to conceive that it is the same cause that produces this appearance on all of them.

The difficulty, however, becomes considerably less, when it is recollected that a person in motion, looking at an object at rest, perceives the same change of position in the object as if he were himself at rest, and the object in motion in the opposite direction. Every one who has looked for the first time from the window of a carriage moving quickly along the road, or from the deck of a ship sailing smoothly along the shore, fancies that every thing which the carriage or vessel passes is in motion, and that he is himself at rest.

An appearance still more deceiving takes place, when a person looks out of the cabin window of a ship in a dark night, at a distant light apparently in motion. For the change of place in the light may arise either from its being really in motion, or on board of another vessel, while the vessel in which the spectator is, is placed at anchor; or the light may be stationary, and its apparent motion occasioned by the motion of the ship which carries the spectator; or it may even be occasioned by the motion of the vessel which carries the light being quicker or slower than the one which carries the spectator. The difficulty in determining to which of these causes the motion of the light is to be attributed, arises from the want of some intervening object whose state is known, and by which the apparent motion may be compared. Now, this is precisely the situation in which we stand with regard to the heavenly bodies, for the motion of the earth on its axis, if it really has such a motion, must be incomparably smoother than any vessel or machine made by human art; and as there is no fixed intermediate object between it and the heavenly bodies, no direct proof of this motion can be obtained.

As far, then, as appearances enable us to judge, either the earth may be at rest, and the heavens carried round it every twenty-four hours, or the heavens may be at rest, and the earth revolve round its axis in the same tim For the rising and setting of the sun and stars, with all the other celestial phenomena, will be presented in the same order, whether the heavens revolve round the earth or the earth round its axis.

However, on comparing these appearances with others which are more within our reach, and with the established laws of motion, we shall find it is much more probable they are occasioned by the revolution of the earth on its axis than the revolution of the whole heavens. For as the heavenly bodies present the same appearances to us, whether the firmament carries them round the earth, or the earth itself revolves in a contrary direction, it seems much more natural to admit the latter hypothesis than the former, and to regard the motion of the heavens as only apparent.

The semi-diameter of the earth is only about 4000 miles, and consequently its circumference is about 25,000 miles.

This is, therefore, the space every point of its equator must pass through if the earth revolves on its axis, which is little more than 1000 miles per hour, or about 17 miles per minute. This velocity is certainly very considerable, being nearly equal to that of a cannon ball when it leaves the mouth of a cannon; but it becomes totally insignificant when compared with the motion of some of the heavenly bodies, required on the other supposition. The distance of the sun from the earth is about ninety-five millions of miles; and therefore, if he revolves round the earth in twenty-four hours, he must pass over more than six times this space in the same time, and consequently must move at the rate of about 25,000,000 miles per hour, which is more than 20,000 times quicker than a cannon ball. The planet Uranus is about twenty times farther distant from the earth than the sun, and consequently the velocity of its daily motion must be twenty times greater. But although these velocities are sufficient to startle the imagination, they are really nothing when compared to the rapidity with which the fixed stars must move to accomplish a revolution round the earth in twenty-four hours. If the distance of the fixed stars be assumed at 200,000 times the distance of the sun from the earth, they must move over the space of 1,400,000,000 miles per second, in order to complete a revolution round the earth in twenty-four hours! This is a degree of velocity of which we can have no kind of conception; and yet, if we consider the velocity which those stars must have that are many thousands of times more distant from the earth, it must be almost infinitely greater. If we, therefore, take into consideration the number of bodies that

must move, and the prodigious rapidity of their motions, to produce the same appearances which the revolution of one body with a comparatively moderate velocity can produce, we shall scarcely hesitate a moment in concluding that the motion of this one body is the true cause of these appearances.

This conclusion must appear still more obvious when we attend to the comparative bulk of these different bodies. Of the planets which belong to the solar system, three of them are known to be much greater than the earth; Jupiter being nearly fifteen hundred times; Saturn, nine hundred times; and Uranus, eighty times. But the sun exceeds them all in magnitude, being considerably more than a million of times greater than the earth. Our ignorance of the real distances of the fixed stars prevents us from ascertaining correctly their real magnitudes; but from what we know of their distances, we are entitled to conclude that they are at least equal in size to the largest of the planets. If such, therefore, be the magnitude of these bodies, how inconsistent would it be with every idea of order and arrangement, to suppose that such a vast number of immense bodies daily revolve round such a little and comparatively insignificant body as the earth! What extraordinary power would be necessary to retain them in their orbits, and counterbalance the amazing centrifugal force which they must possess! The idea, too, of so many immense and independent bodies, so vastly distant from the earth and from each other, performing their revolutions round this little ball, exactly in the same number of seconds, is scarcely to be entertained for a single moment; all the phenomena, especially when supposed to arise from these revolutions, can be satisfactorily and easily accounted for by supposing the earth to revolve on its axis.

If we suppose the planets to be carried round the earth, from east to west, every twenty-four hours, and also allow them a motion peculiar to themselves from west to east, (which they are observed to have,) we produce such a combination of opposite motions as has never yet been observed in any of the heavenly bodies, and which it would be impossible to reconcile with any of the known principles of mechanics. But the rotation of a body on its axis, combined with a motion in its curvilineal orbit, is what we are quite familiar with, and what is exhibited by a school-boy on spinning his top.

But one of the strongest proofs of the rotation of the earth is its figure. For it is now well known that the earth is not a perfect sphere: its polar diameter being considerably less than its equatorial.* It is also known that this is the shape which a spherical body would in time assume, if it revolved on a fixed axis; and therefore it is reasonable to conclude that the spheroidical figure of the earth is occasioned by its rotatory motion. This conclusion is supported by the extraordinary fact, that the difference between the polar and equatorial axis of the earth, as deduced from theory alone, is nearly the same as from actual measurement of various arcs of meridian circles. The same conclusion is further supported by analogy.

A rotatory motion has been observed in several of the other planets, and from west to east, the direction in which the earth must revolve in order to occasion the apparent diurnal motion of the heavens from east to west. Jupiter, a much larger body than the earth, turns round his axis in less than twelve hours. Now, both the earth and Jupiter are known to be flattened at the poles. All these facts, therefore, lead us to conclude that the earth has really a motion of rotation, and that the diurnal motion of the heavens is only an illusion produced by this rotation.

The diurnal rotation of the earth being assented to, its annual motion will scarcely be denied; for its similarity to the other planets is considerably strengthened by this circumstance. For the planets being found to revolve on their axis, and to be flattened at the poles like the earth, and being found to have periodical revolutions from west to east, we are led to suppose that the earth has a *similar* revolution, in order to render the analogy between it and the rest of the planets complete. But the appearances afford us as little assistance in ascertaining the truth of this supposition, as in the case of the diurnal motion; for, whether we suppose the earth to be at rest, and the sun to move round it in the ecliptic in the course of a year, or the sun to be at rest, and the earth to describe this path in the same time, the phenomena of the seasons, eclipses, and all other appearances connected with the sun's annual motion, may be explained on either hypothesis. But, although this be the case, it is much more probable that these appearances are produced by the annual motion of the earth round the sun, than by the motion of the sun round the earth; for, by supposing the earth to move round the sun, we not only give order and simplicity to the solar system, and preserve the analogy which is so conspicuous among the other bodies which

* Some of the objections which have been stated against the rotation of the earth will be noticed in treating of the Ptolemaic and Tychonic systems

compose that system, but we remove several difficulties which unavoidably attend the opposite hypothesis. It has already been remarked, that the earth is considerably smaller than several of the other planets, and that it is about fourteen hundred thousand times less than the sun; it is therefore quite inconsistent with every idea of order and arrangement, to suppose that bodies of such extraordinary size should revolve around one of comparatively small magnitude. For, independent of the complication of the planetary motions which such a supposition would introduce, it would overthrow one of the best established principles of mechanics, and is quite inconsistent with the law which is known to subsist between the times of the revolutions of the planets, and their distance from the sun, for the further they are from the sun their motion is the slower: their periodic times of revolution being to each other as the cubes of their mean distances from the sun. Now, according to this remarkable law, the length of a revolution of the earth round the sun should be exactly a sidereal year. This is therefore an incontestible proof that the earth moves round the sun like the other planets, and is subject to the same laws. To this we may add, that the aspect, of increase and decrease of the planets, the times of their seeming to stand still, and move direct and retrograde, answer precisely with the motion of the earth: but cannot be reconciled with that of the sun, without introducing the most absurd and monstrous suppositions, which would destroy all order, harmony, and simplicity, in the system.

But the most direct proof of the earth's annual motion is derived from the aberration of light. For during the time which light takes to pass over the semi-diameter of the earth's orbit, which is 8′ 13″, the earth ought to move 20″·232 in its orbit, and this is found by observations to be actually the case.

The annual as well as the diurnal motion of the earth may, therefore, be considered as completely established. The objections which have been urged against these motions, by the supporters of the Ptolemaic and Tychonic systems of the heavens, will be noticed when treating of these systems.

To the texts of Scripture which seem to contradict the motions of the earth, the following reply may be made to them all. That it is plain, from many circumstances, that the Scriptures were never designed to instruct men in philosophy, but in matters of religion, and are not always to be taken in the literal sense: for Job describes the earth as being *supported* upon *pillars*, and in another place as being hung upon *nothing*; and Moses calls the moon a great luminary, although it is well known to be an *opaque* body, which shines only by reflecting the light of the sun.

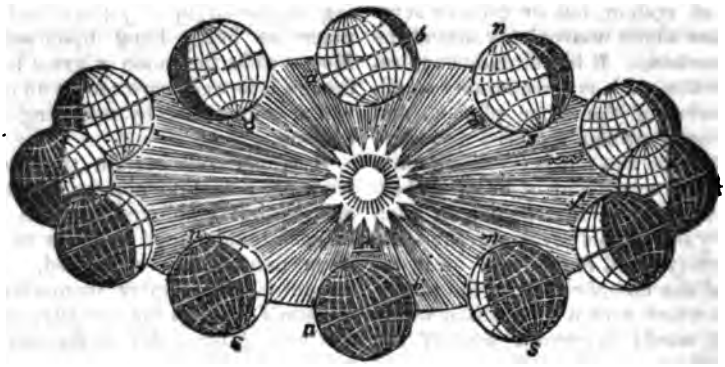
It is perfectly certain these expressions were not meant to convey any astronomical opinion, but employed because they would be easily understood by those to whom they were immediately addressed. In familiar discourse astronomers themselves speak of the sun's place in the ecliptic, of his rising and setting, &c.; for if they did not, they would be under the necessity of explaining their meaning every time they had occasion to mention those appearances.

On the Changes of Seasons.*—The alternate succession of day and night, as well as the variety of seasons, depend entirely on the motions of the earth. For if the sun and the earth were perfectly at rest with respect to each other, it is evident that one half of the earth would always be in the light, and the other half in darkness, as the sun can only enlighten one half of its surface at a time. But as the earth turns round its axis once in twenty-four hours, any particular place on its surface will pass through light and darkness alternately. As long as it continues in the enlightened hemisphere, it will be day at that place; but while it passes through the opposite hemisphere it will be night. But although the regular succession of day and night be occasioned by the diurnal revolution of the earth on its axis, yet this motion is not of itself sufficient to produce that variety in the lengths of days and nights which the various places of the earth experience in the course of a year.

For should it revolve on its axis with one of its poles always pointed exactly to the sun, one half of the earth would be constantly in the light, and the other half in darkness, notwithstanding its rotation. Again, if we suppose the earth to turn on its axis, with its equator directly pointed to the sun, then the light would just reach both poles, consequently all places would be in light and darkness alternately, and the days and nights would be exactly twelve hours each at every part of the globe.

If either extremities of the earth's axis, suppose the northern, were to make an acute angle with an imaginary line joining the centre of the sun with any point of the earth's

* If a terrestrial globe be placed in the various positions mentioned in this article, it will contribute very much to impress the mind with the true cause of the change of the seasons.



equator, it would follow that the north pole, and a certain tract round it, would remain always in the light, notwithstanding the revolution of the earth on its axis. Even those places in the northern hemisphere, to which the sun appears to rise and set, would have their days always longer than their nights; at the equator the days and nights would be equal; but in the southern hemisphere the reverse would happen to what took place in the northern. For those places to which the sun appeared to rise and set would have their nights longer than their days; and the south pole would be constantly in darkness, with a tract around it equal to what was constantly in the light round the north pole. It is evident, also, that in this case the sun would be always on the north side of the equator, and vertical to a certain circle parallel to it, which would be as many degrees from the equator as the angle contained between the earth's axis and the imaginary line wanted of a right angle.

This last supposition is in some degree similar to what actually takes place in nature; for the axis of the earth makes an angle of 23½ degrees with a perpendicular to its orbit; and as the axis always remains parallel to itself, or points in the same direction, this angle must be constantly changing as the earth moves forward in its orbit.*

This is well represented by the annexed figure, which shows the earth at twelve different times of the year.

The line *a b* is the equator, *n* the north pole, and *s* the south. The signs of ♈, ♎, &c. denote the points of the ecliptic in which the earth is when it has the positions in the figure.

As the position of the poles of the earth with respect to the sun depends entirely on this angle, their position must always be changing; and, of course, every point on the earth's surface must also alter its position with respect to the sun. About the 20th of March, when the sun, as seen from the earth, enters the sign Aries, the line supposed to join the centres of the earth and sun is perpendicular to the earth's axis; consequently both poles are similarly situated with respect to the sun, as he is then directly over the equator, and the days and nights are equal at every place on the globe. This time of the year is called the *vernal* equinox, because spring commences to the inhabitants of the northern hemisphere, while autumn begins to those of the southern.

Swiftness of the Ostrich.—The bird most celebrated for fleetness of running is the ostrich, or bird camel, (*Struthio Camelus,*) as it may well be named. "What time she lifteth up herself on high," says Job, "she scorneth the horse and his rider."* According to Dr. Shaw, the wings serve her both for sails and oars, whilst her feet, which have only two toes, and are not unlike the camel's, can bear great fatigue. Though the ostrich is universally admitted to go faster than the fleetest horse, yet the Arabs on horseback contrive to run these birds down, their feathers being valuable, and their flesh not to be despised. The best horses are trained for this chase. When the hunter has started his game, he puts his horse upon a gentle gallop, so as to keep the ostrich in sight, without coming too near to alarm it, and put it to its full speed. Upon observing itself pursued, therefore, it begins to run at first but gently, its wings like two arms keeping alternate motion with its feet. It seldom runs in a direct line, but, like the hare, doubles, or rather courses in a circular manner; while the hunters, taking the diameter, or

* Or, what amounts to the same thing, the axis of the earth makes an angle with the plane of the ecliptic of 66½ degrees.

* Job, xxxix. 18.

tracing a small circle, meet the bird at unexpected turns, and with less fatigue to the horses. This chase is often continued for a day or two, when the poor ostrich is starved out and exhausted, and finding all power of escape impossible, it endeavors to hide itself from the enemies it cannot avoid, running into some thicket, or burying its head in the sand: the hunters then rush in at full speed, leading as much as possible against the wind, and kill the bird with clubs, lest the feathers should be soiled with blood.

M. Adanson saw two tame ostriches which had been kept two years at the factory of Podor, on the south bank of the Niger. "They were so tame," he says, "that two little blacks mounted both together on the back of the largest: no sooner did he feel their weight, than he began to run as fast as ever he could, till he carried them several times round the village; and it was impossible to stop him, otherwise than by obstructing the passage. This sight pleased me so well, that I would have it repeated: and to try their strength, I made a full grown negro mount the smallest, and two others the largest. This burden did not seem to be at all disproportioned to their strength. At first they went a moderate gallop; when they were heated a little they expanded their wings, as if it were to catch the wind, and they moved with such fleetness that they seemed to be off the ground. Everybody must some time or other have seen a partridge run, consequently must know there is no man whatever able to keep up with it; and it is easy to imagine, that if this bird had a longer step, its speed would be considerably augmented. The ostrich moves like the partridge, with both these advantages; and I am satisfied that those I am speaking of would have distanced the fleetest racehorses that were ever bred in England. It is true, they would not hold out so long as a horse; but, without all doubt, they would be able to perform the race in less time. I have frequently beheld this sight, which is capable of giving one an idea of the prodigious strength of an ostrich, and of showing what use it might be of, had we but the method of breaking it and managing it as we do a horse."

The traveller, Moore, mentions that he saw a man journeying mounted upon an ostrich; though both this and the instance given by M. Adanson show the circumstance to be of unusual occurrence.—[From the "Faculties of Birds."]

Woollen Cloth made from Old Rags.—It is probably very little known, that an extensive manufacture is carried on in this neighborhood by which old rags are made into new cloth: yet such is the fact, and to so great an extent that at least 5,000,000 lbs. weight of woollen rags are yearly imported from Germany, and other parts, for this purpose. The rags are subjected to a machine which tears them in pieces, and reduces them to nearly their primitive state of wool; and they are then, with a small admixture of new wool, again carded, slubbed, spun, and woven, and they make a cloth not very strong, but answering very well for paddings, shoddies, and other similar purposes. The manufacture is carried on chiefly in the neighborhood of Batley.—[Leeds Mercury.]

Parisian Steam Carriage.—Last week, Messrs. Dietz & Hermann made an experimental trip with a steam carriage of their construction on the road to Vincennes from Paris. This machine, carrying twenty persons, ran from the Barriere du Trone to the Castle of Vincennes, a distance of three quarters of a league, in 11 minutes. It afterwards took an omnibus in tow, in which, and upon the machine itself, there were 48 passengers, and went at the rate of three leagues an hour as far as Nugent. On its return, near the Castle of Vincennes, a tube burst, but it was quickly repaired, and the machine with the omnibus attached to it, and both laden with 53 passengers, reached the Haymarket, Faubourg St. Antoine, in 12 minutes.

A Curious Piece of Machinery to measure Time has been invented by Mr. Andrew Symington, watch-maker, in Kettle. This time-piece is much more simple in its construction than the common eight-day clock, requires only to be wound up once in twelve months, and being quite silent in its movements will be admirably adapted for bedrooms. In this time-piece the pendulum and escapement are done away with, and a simple but efficient substitute is applied to the crown wheel, as in detents, which only allows it to revolve once in an hour, and has quite an uniform motion, without producing the smallest vibration in the machinery. Another important part of the discovery is a particular material for the pivots to move in, which is quite free from any cohesive quality, and requires no oil, therefore avoiding the irregular motion produced by the evaporation of the oil and other causes. Mr. Symington is about to construct a clock on this plan, to be sent to London, for the purpose of being exhibited there.—[Fife Herald.]

The Mr. Symington here mentioned is a son of the late eminent William Symington, the father of modern steam navigation.—[London Mechanics' Magazine.]

MISCELLANIES, *Foreign and Domestic.*—The following notices are translated from Berzelius's last yearly report on the Progress of Science, by Dr. Lewis Feuchtwanger, of New-York.—[American Journal of Science and Arts.]

1. *A new ore of Antimony* has been discovered in the Hartz mountains by Zinkin, which resembles zinkenite, and appears to be also a subantimonio-sulphuret of sulphuret of lead with sulphuret of silver.

2. *A new Tenantite* has been examined by Hemming from a newly opened mine in Cornwall, which consists of

Arsenic	11·5
Copper	48·4
Iron	14·2
Sulphur	21·8
Silex and Gangue	5·

3. *Vanadiate of Lead.*—Johnson discovered some species of vanadiate of oxide of lead at Wanlockhead in Scotland; one species occurs on calamine in form of warts, and as large as a pin's head. It is of a dirty white, and appears to be dew of a pale red powder, has a resinous fracture, and specific gravity of about 7. The other is black, and looks like earthy manganese; a third has not yet been described, but Johnston has sent specimens to the Collection of the *Royal* Swedish Academy. It is regularly crystallized, and appears to be a bi-vanadiate of the oxide of lead.

4. *Plumbacalcite* has been described by Johnson as a mineral found at Wanlockhead in Scotland; it consists of carbonate of lime and carbonate of lead; it is crystallized in the primitive rhomboid of the calcareous spar; it occurs both transparent and opaque, and consists of 92·2 carbonate of lime, 7·8 carbonate of lead. By heat the carbonic acid is evolved, and the mineral assumes a reddish color. This mineral offers an interesting proof of the isomorphism of oxide of lead with a rhomboid of carbonate of lime.

5. *Pelokonite.*—Richter describes an uncrystallized mineral, occurring in Chili, with malachite and copper-green under the above name, (from πηλος brown, and κονις powder.) It contains phosphoric acid and the oxides of iron, manganese, and copper; it has a blackish blue color, gives a liver brown streak of a conchoidal fracture and weak lustre; its specific gravity is between 2·5 and 2·57.

6. *Wolchouskoit.*—Kammerer described a new mineral from Siberia, which is amorphous, bluish green opake, and of conchoidal fracture; its touch is greasy, gives a bluish green streak, and adheres slightly to the tongue; consists of silica, alumina, oxide of chrome, and water.

7. *Worthite.*—This new mineral has been described by *Hess*, and found in a scapolitic boulder from the neighborhood of Petersburg. It is colorless, crystalline foliated, of specific gravity of about 3·0; harder than quartz, infusible before the blow-pipe, and dissolves with difficulty and with effervescence; in soda it becomes transparent, and yields water by heating in a tube; it becomes dark blue with nitrate of cobalt. Hess found it composed of

Silica	40·58
Alumina	53·80
Magnesia	1·00
Water	4·63

The formula is AAq + SS.

8. *Pyrargillite.*—Nordenskold discovered and analyzed two new minerals from Finland, the one he calls by the above name from its character of diffusing a clayey smell by heat. It is partly black, light, and lustrous, like the Lordawalite, and partly bluish granular or red, and without lustre; it seldom occurs pure in uncrystallized masses, the form of which approaches to a four-sided prism, with truncated angles; sometimes it is traversed with chlorite, so as to appear sparkling by polishing; its specific gravity is 2·505; its hardness 3·5; it is decomposed completely by muriatic acid; it occurs in granite, and it consists of

Silica	43·93
Alumina	28·93
Protoxide of Iron	5·30
Magnesia with some Protoxide of Manganese	2·90
Potassa	1.05
Soda	1·85
Water	15·47
Loss	0·58

Formula. $\left.\begin{matrix} F \\ M \\ Mg \\ N \\ K \end{matrix}\right\} S^3 + 4AS + Aq.$

9. *Amphodellite.*—This is the other mineral discovered by the above author from the lime quarries of Lozo, in Finland; its crystallized form bears much analogy to that of felspar; it is clear reddish, resembles in fracture scapolite, with two passages, which form an angle of 95° 9′; its hardness is 4·5, and its specific gravity 2·793; it consists of

Silica	45·80
Alumina	35·45
Lime	10.15
Magnesia	5·05
Protoxide of Iron	1·70
Moisture and Loss	1.85

Its Formula, $\left.\begin{matrix}C\\F\\Mg\end{matrix}\right\}S+3AS.$

There are a few more minerals described which seem to require a thorough examination in order to establish their claims to be called new, as for instance *Skugisan* and *Monophan*, belonging to the family of the zeolites, and noticed by Breithaupt.

The Mengite from Siberia, and the Monticellite from Vesuvius, and noticed by Brooke and Berzelius from Galloro near Rome, a kind of anhydrous zeolite, which is difficult to fuse, and becomes gelatinous with muriatic acid; it is noticed by Necker De Saussure.

In regard to the Xanthite, described in a former number of this Journal, which occurs in Orange County, N. Y., and consists of

Silica	32·708
Lime	36·308
Alumina	12·280
Oxide of Iron	12·000
Protoxide of Manganese	3·680
Moisture	0·600
Loss	24·24

Berzelius observes, that if this analysis approaches to accuracy, and if a small part of the oxide of iron is contained in the mineral as a protoxide, the formula would be $2\left\{\begin{matrix}C\\Mg\\F\end{matrix}\right\}S+\frac{A^3}{F^2}S.$

10. *Ozokerite, a new combustible Mineral.*—This mineral occurs at Slauik, Moldavian District, near the Karparthes, and has been called by Glooker, Ozokerite (ὀζειν to smell, κηρος wax); it is of a talcose structure, the color between green and brown, of the specific gravity 0·955 to 0·970; it may be kneaded between the fingers, melts into a clear mass in the flame of a candle, is soluble neither in alcohol nor water, even when boiling, and but slowly so in ether and spirits of turpentine. This mineral may serve as an excellent material for lamps or tapers, burning like wax, with soft clear flame, and diffusing on its being extinguished an agreeable odor. Specimens are shortly expected from the locality.

11. *Platinum in France.*—A specimen of platinum has been exhibited before the academy at Paris, which has been extracted in combination with silver from galena, and which contains 0·00022 of Platinum; and since 1100 lbs. of the galena are daily produced from the mines, the daily produce of platinum will be 1 lb. 4 oz. 4 drams and 28 grains. The mines of Cohfolens and Allone Depart. of Choraute are the localities for this platinum.

THE PIETY OF NEWTON AND LOCKE.—The grand and sublime idea of Divinity is the greatest blessing that ever was bestowed on man. This idea or impression from Deity, though common to the human family, is most powerfully developed in the cultivated mind. After the immortal Newton had traced the hand of Omnipotence through the planetary system, he was so struck with the mighty power of God, that he never heard his sacred name repeated without reverently "bowing his head." Locke, another philosopher, equally of the first order, has, like Newton, testified his adoration of Jehovah. Those justly celebrated authors had studied and reflected too profoundly to be ignorant of the attributes of Deity, or the nothingness of man. Their humble and enlightened piety rendered them conscious of their dependence upon the great source of perfection from whence every blessing flows. After the example of Locke and Newton, how can we justify the thoughtless and insensible part of creation, who, far from acknowledging their gratitude to the Author of all good, have even denied his existence—As in scripture, "the fool hath said in his heart there is no God." The wise and good man will behold God in all his works. SANS SOUCI.—[Translated from the French.]

COPPER IN VEGETABLES.—Some experiments recently made by M. Farzeau in France, have demonstrated the presence of this metal in the vegetables used as food. These experiments have been made with so much accuracy as to demonstrate the actual weight of copper in each plant. The examination shows the proportion to be a few miligrammes of copper to each kilogramme of the plant. Wheat contains 4,666 miligrammes of copper for the kilogramme, flour only 0.666, but the copper is contained in the bran and not in the farinaceous portion, so that the bread made with the coarsest flour is that which contains the largest proportion of the metal. M. Farzeau, indefatigable in his researches, wished to ascertain the quantity of copper which in a given time a man would mix with his bread. According to his calculation a man would eat in the course of fifty years, 6.09 grammes—a very small quantity, in truth, and which could produce no injury. The quantity of bread daily produced in France being 18,000,000 of kilogrammes, there would be consequently 10 kilogrammes of copper eaten daily, or 3650 per year. On the other hand, since the amount of wheat necessary to feed France for a year is nearly 7,600,000,000 of kilogrammes, it results that this quantity of wheat takes from the soil 34,961 kilogrammes 800 grammes of copper—an enormous quantity—which equally proves the abundance of copper in the soil, and its minuteness of division.—[Boston Medical Journal.]

GEOLOGICAL SURVEYS.—The Geological Society of Pennsylvania has employed Mr. S. Clenison to visit and report on the gold region recently discovered in York county, in that State. This gentleman has recently returned from Paris, where he has served a long and faithful apprenticeship in the school of mines. The Legislature of Tennessee has recently appointed Dr. G. Troost to make a similar survey of the State. Professor Hitchcock has completed his geological survey of the State of Massachusetts. Professor Ducatel is appointed by the Legislature of Maryland to make a geological and topographical survey of that State. Mr. G. W. Featherstonhaugh is engaged under the authority of the United States in a geological and mineralogical investigation of the territory of the Arkansas: his report is expected to be made to Congress in February next. These various and simultaneous appointments evince a determination to develope the mineral resources of the country in good earnest.—[New-York Enquirer.]

TIDES.—It is intended to make a series of tidal observations round the coast of Great Britain and Ireland, on the same days, for 16 days together, from 7th to 22d June next. The object is, to ascertain by how much the time of high and low water at each place is before or after those times at the neighboring places; and also to determine, wherever it can be done conveniently, the comparative rise and fall of the tides at the different intervals between the morning and evening tides, or any other differences which regularly affect their height. For this purpose the exact time of high and low water, especially of the former, and the height above or below some fixed mark, are to be observed every day and night during the above mentioned period. The observations thus made, and the results of the comparison of these with others, will be published along with the names of the officers by whom they have been superintended.—[From Instructions issued by the Admiralty.]

GREAT CASTINGS.—The Screw Dock Company, in New-York, has just imported a pair of hydraulic presses, to be used in raising ships of a large class. The castings for these presses are enormous. The cylinders weigh sixteen tons each, and measure about seventeen feet in length, and nearly three feet in diameter. The original cost was £15 or $50 a ton; the freight in the packet ship George Washington, £150 sterling, or $700; the duty $800; and the expense of landing them from the ship $200. The gross cost is but about five cents a pound. We presume that so large castings as these have never before been seen in this country. The founder in England stated that it had occupied forty men two days to remove them from one side of his shop to the other.—[Jour. Com.]

We have received, by the packet Napoleon, (says the American Railroad Journal of Oct. 4,) a communication from a friend relative to the proposed railway from Amsterdam to Cologne. Aiming, as we do, to make our Journal a medium of transmission for information on all projects of internal improvement, whether in our country or abroad, we have extracted the following general facts in relation to the above important undertaking.

"This work having received the sanction of the King of the Netherlands, and the King of Prussia, will be immediately commenced under the superintendence of Lieutenant Colonel Bake. The total estimate for the construction of the road, purchase of property, and locomotive engines, warehouses, &c., is estimated at 12,000,000 florins, or about 5,000,000 of dollars. This road is intended to facilitate the intercourse between the great continental emporium, the port of Amsterdam, and the important town of Cologne; from which latter city there exists a good steamboat navigation up the Rhine to Basle. The passage between Amsterdam and Cologne is expected to be performed by the trains of passenger cars in from 10 to 11 hours. The annual trade at present between the two places is 168,000 tons of merchandise, 300,000 tons of coal, and 22,000 passengers,—the transportation of the whole of which, the directors think, may safely be depended upon as being diverted to the railway."

LIVERPOOL AND MANCHESTER RAILWAY.—According to the report read at the half-yearly meeting of this Company, recently held at Liverpool, it appeared that the increase of the number of passengers, in the half-year ending 30th June, was 29,255, and of merchandise 7727 tons, conveyed to and from Manchester. The amount of receipts for passengers was 50,770*l.* 6*s.* 11*d.*; for merchandise, 44,014*l.* 5*s.* 4*d.*; total receipts, 94,784*l.* 12*s.* 3*d.*; total amount of expenses, 60,092*l.* 15*s.* 11*d.*; net profit, 36,691*l.* 16*s.* 4*d.*; added to this was 1332*l.* 2*s.* 2*d.*, the surplus profit of the half-year ending 30th June, 1833, making 36,023*l.* 18*s.* 6*d.*, from which sum the committee were enabled to recommend a dividend of 4*l.* 10*s.* per share.

THE BENGAL STEAM FUND COMMITTEE have advertised, in the Indian papers, that the steamer "Forbes" would start from Kedgeree, for Suez, on the 15th April; so that by this time the letters and passengers ought to have arrived in England. As great dissatisfaction has been excited in the other Presidencies at the preference given to Bengal, something may have occurred to prevent the vessel's setting out at the appointed time. She was to carry only nine passengers—three from Bengal, and two each from Bombay, Madras, and Ceylon.—[London Mechanics' Magazine.]

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MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING OCTOBER 18, 1834. [NUMBER 4.

"If it be true that a wise man, like a good refiner, can gather gold out of the drossiest volume, and that a fool will be a fool with the best book,—yea, or without a book,—there is no reason that we should deprive a wise man of any advantage to his wisdom, while we seek to restrain from a fool that which, being restrained, will be no hindrance to his folly."—MILTON.

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from page 154.)

OF SENSIBILITY.—Under this head are comprehended, not any sentiment or feeling of the mind, but the sensations of the body.

We form our notions of sensibility from that of the skin; and it is no doubt necessary that we should do so. It is in constant communication with things around us, and affected by their qualities; it affords us information, which corrects the notions received from the other organs of sense, and it excites our attention to preserve our bodies from injury. We are so familiar with the painful effects of injuries upon the surface, that there is nobody who does not imagine that the deeper the injury the more dreadful the pain. But, on the contrary, it is a well established fact, that to such irritants as would give the skin pain, the internal parts are totally insensible. And it is equally certain, that though the nerves, the instruments of sensation, are incapable of producing any perception without the brain, yet the brain itself, the part which is the seat of intellect, and to which every impression must be referred before we become conscious of it, is itself as insensible as leather. These considerations show us, that sensibility to pain is not a necessary result of life, and they naturally lead to the inquiry for what purpose is sensibility bestowed, and how is it distributed in the body?

We have first to show that the skin has sensibilities exactly suited to the functions it has to perform. Science no doubt informs us, that warmth and cold are only relative degrees of heat; to the skin they are distinct sensations, and excite in different ways both the mind and the bodily functions. Cold braces and animates to exertion, whilst the warmth, which is pleasant to us, is genial to all the operations of the animal economy. Their alternations are the most constant sources of our enjoyment, and at the same time conduce to exertion and to health. All this, however, belongs to the skin exclusively; parts internal, although peculiarly sensible to their proper stimulus, give no indication of sensibility to heat; if there be internal sensibilities of heat, they are morbid and deceptious. Molten lead would produce pain and death, being poured into the interior of the body, but the sensation of burning is a property of the surface only. It is the excess of that particular sensation, which is calculated, like the other endowments of the skin, to suit the medium in which we live, and to force us to the regulation of the temperature necessary to preserve life.

Touch, or the sensibility to bodies pressed upon the skin, is likewise a distinct and appropriate sense. The sensibility of the skin to pricking, cutting, or tearing, is also in curious contrast with the sensibility of the solid internal textures, as bone, cartilage, and ligament. We have arrived at the full comprehension of this subject very slowly. Disagreeable experiments have been made, but the following is as interesting as it was innocently performed. A man who had his finger torn off, so as to hang by the tendon only, came to a pupil of Dr. Hunter. "I shall now see," said the surgeon, "whether this man has any sensibility in his tendon." He laid a cord along the finger, and, blindfolding the patient, cut across the tendon. "Tell me," he asked, "what I have cut across?" "Why, you have cut across the cord, to be sure," was the answer. By such experiments it became very manifest, that bone, gristle, and ligament, were insensible to pricking, cutting, and burning. Were they therefore insensible? The reader will answer—Surely, it is a matter proved. But before we finally decide, let us take this into consideration,—that the sensibilities of the body differ in kind as well as in degree; and every part has its peculiar kind, as well as its degree: and every part has its kind of

sensibility with reference to its function, and also with reference to its protection from violence. If the membranes between the bones of our great joints, or the cords which knit the bones, were sensible in the same manner and degree with the skin, we should be incapable of motion, and screwed to our seats, as the man appears to be who has a violent attack of acute rheumatism.

But although these bones and cartilages, or gristles, and ligaments, be not sensible as the skin, or the surface of the eye, they possess that which is suited to their condition, which permits their free use, and yet limits that too free exercise which would be injurious to their textures, or raise inflammation in them. The ligaments and tendons, then, which are insensible to pricking, cutting, and burning, are sensible, nevertheless, to stretching and tearing! It is remarkable that such men as Drs. Hunter and Haller, the luminaries of their science, should have held the opinion that the bone and the membrane which covers it (the *periosteum*), the gristles or cartilages, the ligaments of joints, and the tendons of muscles, were insensible parts, and yet be in daily attendance on those who suffer the pain of a sprained ankle, where there are no parts to suffer but those enumerated, and where the pain, excessive in degree, was felt in the instant of the sprain. These considerations explain to us that pain is the safeguard of the body. This capacity of conveying painful impressions to the mind is not given superfluously to all parts; on the contrary, the safe exercise and the enjoyment of every part is permitted without alloy, and only the excess restrained.

This subject is finely illustrated by the apparent insensibility of the heart. The observation of the admirable Harvey, the discoverer of the circulation of the blood, is to this effect. A noble youth, of the family of Montgomery, from a fall and consequent abscess on the side of the chest, had the interior marvellously exposed, so that after his cure, on his return from his travels, the heart and lungs were still visible, and could be handled; which, when it was communicated to Charles I., he expressed a desire that Harvey should be permitted to see the youth and examine his heart. "When," says Harvey, "I had paid my respects to this young nobleman, and conveyed to him the king's request, he made no concealment, but exposed the left side of his breast, when I saw a cavity into which I could introduce my fingers and thumb; astonished with the novelty, again and again I explored the wound, and first marvelling at the extraordinary nature of the cure, I set about the examination of the heart. Taking it in one hand, and placing the finger of the other on the pulse at the wrist, I satisfied myself that it was indeed the heart which I grasped. I then brought him to the king that he might behold and touch so extraordinary a thing, and that he might perceive, as I did, that unless when we touched the outer skin, or when he saw our fingers in the cavity, this young nobleman knew not that we touched the heart!" Other observations confirm this great authority, and the heart is declared insensible. And yet the opinions of mankind must not be lightly condemned. Not only does every emotion of the mind affect the heart, but every change in the condition of the body is attended with a corresponding change in the heart: motion during health—the influence of disease—every passing thought, will influence it. Here is the distinction manifested. The sensibility of the skin is for a purpose, and so is the sensibility of the heart. Whilst the skin informs us of the qualities of the external world, and guards us against injury from without, the heart, insensible to touch, is yet alive to every variation in the constitutional powers, and subject to change from every internal influence.

There is in the several organs of the body, as it were, a distinct life; that is, they possess sensibility, the grand endowment of life, necessary to their condition, and adapted to their appropriate stimulus. The impressions made upon them will sometimes rouse them into activity, or call muscles into action which are necessary to their functions or for their protection; and this oftentimes without reference to the mind at all, and consequently without our consciousness.

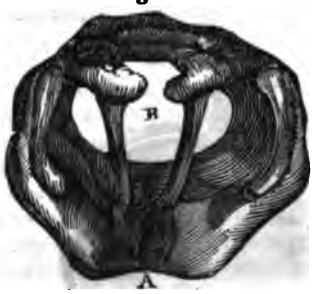
Perhaps we have the most agreeable example of this in the eye. That organ has been selected in the Preliminary Discourse of the Objects and Pleasures of Science, as showing how mechanical advantage is taken in the arrangement of the muscles to produce velocity of movement in guarding the eye. But this fine mechanism would be lost if the excitement depended on our will,—if there were not a sensibility appropriated to the action, and an influence quicker than thought. It is not by feeling the pain of the offensive body, or by estimating its dangers, and acting on the conviction, that we close the eye to avoid injuries. This would be an operation all too slow for the intended purpose; and, therefore, the muscles, possessing these extraordinary provisions, are put in relation with a sensibility more admirable still. So when a light foreign body touches the eye-lashes, they give alarm, and cause a motion, both of the eye-lids and eye-

ball, quicker than thought. The eye-lashes, seated on the tender extremities of sensitive nerves, preserve the eye in two ways—by guarding its interior from the lateral light, and by exciting the motion of the eye-lids, even before the offensive body can touch the eye's surface.

We may take another illustration to show how sensibility, one of the endowments of the living part, is adapted to the mechanical organization, and with an appropriation more admirable than the mechanism. When we speak of the sensibility of the skin, it is still possible to misconceive its nature, and to suppose it accident merely; but in the instance to be adduced, the sensibility is different, and it is put in connection with a hundred muscles; without this high and peculiar sensibility, and its multiplied relations to muscles, independent of volition, the mechanism we are about to describe would be quite useless.

The top of the wind-pipe is called the *larynx*, and consists of five elastic cartilages. These do not merely keep the sides of the wind-pipe apart, and the passage for the breath free, but they perform offices important to the economy both of body and mind; they are an essential part of the instrument of voice; they at the same time guard the lungs from injury.

Fig. 24.



The *thyroid* cartilage is the largest of the cartilages of the larynx, it is that we feel projecting on the fore part of the throat, called the *pomum adami*, (A.) It is a protection to the fine apparatus behind it, and indeed this is the reason of its name, (*scutiform*, like a shield.) Within the thyroid stand the *arytænoid* cartilages, (B.) This cartilage is of an irregular triangular form. It is socketed or articulated on the cartilage below, and is perfectly moveable. To the corner which projects forwards the ligament (B) is fixed, and to its other sides five little muscles are attached; these muscles, by moving the cartilage, draw and vary the position of the ligament. It is these cartilages and this ligament, which, vibrating in the stream of air, give the tremor, and vocalize the breath; the tones so produced are articulated in speech.

Fig. 25.

This is a subject far from being exhausted in our philosophical works, and may call for observation afterwards;* but at present we may look on these ligaments, not as the *corda vocales*, but in another of their offices —forming the slit which opens and shuts in breathing, for the protection of the lungs. But here it is pertinent to remark, that in the structure of an animal body one organ is made subservient to several functions, without interference in the performance of any of them. This is especially true of the larynx. It is one of those uses only, and the least important, that we have at present to observe.

The ligaments being invested with the lining coat, or membrane of the wind-pipe, draw it into the form of a slit like the till of a shop counter, and this is the chink of the glottis (*rima glottidis.*) This slit opens and closes with every inspiration, moving as we see the nostrils do in breathing. But the most admirable thing of all is the acute sensibility given to this part, and to no other, so that the lightest husk, or seed, or smallest fly, drawn in with the breath, and touching the margin of the chink, is caught there by the rapid action of the muscles and consequent closing of the aperture. Now, were the provision for the protection of the lungs to be only thus far perfect, there would be an effectual means of preventing the intrusion of foreign matter into the delicate cells of the lungs, but not for its expulsion from the entrance which it had reached. Accordingly, although the sensibility of the glottis is put in operation with the shutting of the chink, it also animates another class of muscles, viz. all those which, seated on the chest, compress it, and force out the air in coughing; and these combining in one powerful and simultaneous effort, whilst the

* For a full description of the Vocal Organs, together with engravings illustrative of the same, the reader is referred to page 117, vol. iii. of this Magazine.

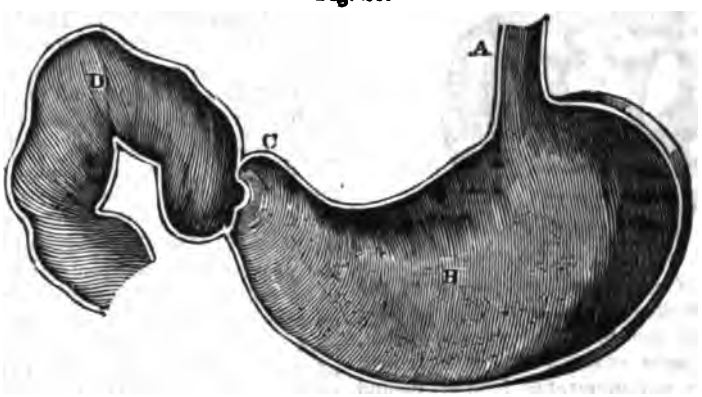
glottis is closed, overcome that constriction, and propel the breath through the contracted pipe with an explosive force, which brushes off the offending body. There is one thing more necessary to this most important though familiar action—the lungs are never empty of air: in breathing we do not fully expel the air; if we did, there would be a period of danger occurring 17 times in a minute, for in the first part of each inspiration, something might be drawn into the wind-pipe which would suffocate. But by this provision of air retained in the lungs more than necessary to respiration, and which it is possible to expel by a more forcible expiration, there is always a possibility of coughing and expelling the offensive thing at any point of time in the act of inspiration.

The sensibility seated in a spot of the throat so beneficently, does not extend into the wind-pipe; for we cannot more admire the perfect adaptation of this living property, than the circumstance of its never being bestowed in a superfluous degree, nor extended where it is not absolutely required. Just as the sensibility of the skin protects the parts beneath, so in the same manner does the sensibility of the top of the wind-pipe protect all the interior of the tube, and the lungs themselves, without the necessity of this property of irritability extending through the whole continuous surface.

The simple act of sneezing affords a very curious instance of the mutual adaptation of muscular activity and the governing sensibility. The sensation which gives rise to this convulsive act is seated in the membrane of the interior of the nostrils, and we are not surprised with the difference of sensation from that in the throat which excites coughing. But is it not a very curious thing to find some twenty muscles thrown out of the action excited by irritation of the nose; and as many excited which were not in the class of those influenced in coughing; and for the very obvious purpose of shutting the passage by the mouth, or at least forcibly driving the air through the nostrils? No act of the will could so successfully propel the air through the nose in such a way as to remove the offensive and irritating particles from the membrane of the nose, and clear those passages.

These last examples of an appropriate sensibility might introduce us to an acquaintance with those internal sensibilities which govern the actions of parts quite removed from the influence of the will; but the description of them may be deemed unnecessary. We shall just hint at the guard which nature has placed on the lower orifice of the stomach, to check the passage which the appetites of hunger and thirst may have given at the upper orifice (A) to

Fig. 26.



aliments not easy of digestion. This lower orifice (C) is encircled with a muscular ring; the ring is in the keeping of a watchful guard. If we are employing the language of metaphor, it is of ancient use. The Greeks called this orifice *pylorus*, which signifies a porter,* and his office is this: When the stomach has received the food, it lies towards the left extremity, or is slightly agitated there. When the digestive process is accomplished, the stomach urges the food towards the lower orifice. If the matter be bland and natural, it passes, and no sensation is experienced. But if crude and undigested matter be presented, opposition is offered to its passage, and a contention is begun which happily terminates in the food be-

* The upper orifice was called by them *œsophagus*, as it were the *purveyor*, from two words signifying to bring food.

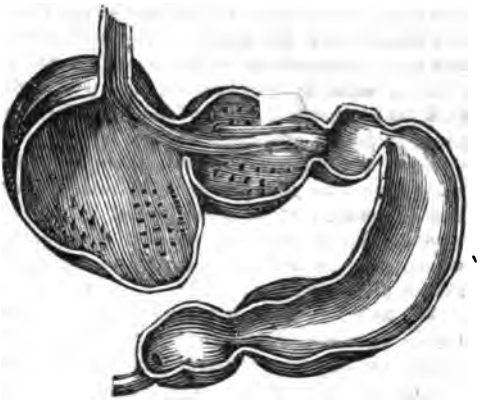
ing thrown again to the left extremity of the stomach, to be submitted to a more perfect operation of the digestive powers seated there. It is during this unnatural retrograde movement of the food that men are made sensible of having a stomach. Yet the sensations, how unpleasant soever, are not to be regarded as a punishment, but rather as a call on reason to aid the instinctive powers, and to guard against disease by preventing impure matter from being admitted into the portion of the intestinal canal which absorbs, and would thus carry, those impurities into the blood to engender disease.

Such are a few examples of the variety in the sensibilities of the animal frame; guarding us against external influences when they would threaten destruction to the framework, and adjusting the operations of internal parts too complicated and too remotely situated for the superintendence of reason.

Medical authors, without being empirics, do, notwithstanding, take great advantage of our ignorance. We can all of us take warning from the sensations experienced in the process of digestion, and there can be no harm in giving every man a confidence in the sensibility of his stomach, and in its indications of healthy or disturbed functions. We have the best proof of what we wish to inculcate in the action of the ruminating stomach. A cow swallows the gross herbage, and fills its large first stomach. When it chews the cud, the stomach, by its action, rolls up the grass into distinct pellets, or balls, with as much regard to the office of its being rejected into the mouth, as we do in masticating for swallowing. When the ball is brought into the mouth and chewed, it is again swallowed; but in descending into the lower part of the gullet, a muscle draws close the aperture by which it passed into the large stomach in the first instance, and it is now ushered into a second stomach, and so successively onwards to that stomach in which the digestion is performed. The curious muscular apparatus by which this is accomplished needs not to be described; but surely, the sensibility which directs it, which, kept apart altogether from the will, is yet in its results so like the operations of reason, presents a subject of just admiration.

The elastic structure of the camel's foot, the provision around its eyes for ridding them of offensive particles, the power of closing its nostrils against the clouds of sand, and its endurance of fatigue, would not enable it to pass the desert, unless there were provisions for the lodgement of water in its stomach, and unless this apparatus were animated by peculiar sensibilities; for there

Fig. 27.



are muscles to retain the fluid in the cells of its stomach, only permitting it to ooze out according to the necessities of the animal; and there is a muscle, represented in the figure above, which pulls up the one or the other of the orifices of the different stomachs, to receive the food from the lower end of the gullet, according to its condition, whether to be deposited merely as in a store, or to be submitted to the operation of digestion.

The surprising thing in all this is not so much the mechanical provision as the governing sensibility. What, for example, should in the first place impel the grosser food, when collected, into the first stomach? What should, in the next place, and after rumination and mastication in the mouth, carry it into the third stomach; since water is carried into neither of these, but into the cells of the second stomach?

Yet, after all, this only brings us back to a sense of the operations of our own bodies. The act of swallowing, the propulsion of the food into the gullet, and the temporary closing of the wind-pipe at such a time, is just as surprising. This latter operation is never deranged but by the interference of the will. If the individual attempts to speak, that is, to govern these parts by the will, when they should be left to these instinctive operations, or if terror, or some such mental excitement, prevail at the moment of swallowing, then the morsel may stick in the throat.

All this shows how perfect the operations of nature are, and how well it is provided that the vital motions should be withdrawn from the control of reason, and even of volition, and subjected to a more uniform and certain law.

But the point to which we would carry the reader is this, that though there are the proper sensibilities of the body, with refer-

ence to perception or consciousness, yet there are others no less curious, which control the internal operations of the economy; and that the mechanical provisions are but a type of what is promised to him who will look into the sensibilities of the body for the proof of power and contrivance.

Now, the human stomach, though not so complicated in its apparatus of macerating and digesting vats, is possessed of a no less wonderful degree of governing sensibility, which may be trusted as surely as the most skilful physiologist.

We are told that we must not drink at meals, lest the fluid interfere with the operation of digestion; and of this there need be no apprehension. The stomach separates and lets off with the most curious skill all superfluous fluid through its orifice, while it retains the matter fit for digestion. It retains it in its left extremity, permitting the fluid to pass into the intestines, there to supply the other wants of the system no less important than the digestion. The veterinary professor, Coleman, ascertained that a pail of water passed through the stomach and intestines of a horse at the rate of ten feet in the minute, until it reached the cæcum. Drinking at a stated period after meals, say an hour, is at variance with both appetite and reason. The digestion is then effectually interfered with; for what was solid has become a fluid, (the *chyme*.) This fluid is already in part assimilated; it has undergone the first of those changes which fit it ultimately to be the living blood; and the drink mixing with this chyme in the inferior extremity of the stomach, or first intestine, must produce disturbance, and interrupt the work of assimilation.

Looking in this manner upon the very extraordinary properties of the stomach, we perceive how natural it was for physicians to give a name to the sensibility of which we have been speaking. The *Archeus* of Vanhelmont, the *Anima* of Stahl, were the terms used to designate this nature, principle, or faculty, subordinate to and distinct from perception: a notion entertained, and more or less distinctly hinted at, by philosophers from Pythagoras to John Hunter.

A modern philosopher,* of whom, in this instance, it would be difficult to say whether he be serious or playful, with some plausibility, however, asserts that it might be possible to carry on the business of life without pain. If animals can be free from it an hour, they might enjoy a perpetual exemption from it. Animals might be constantly in a state of enjoyment; instead of pain, they might feel a diminution of pleasure, and might thus be prompted to seek that which is necessary to their existence.

In the lower creatures, governed by instinct, there may be, for aught we know, some such condition of existence. But the complexity and delicacy of the human frame is necessary for sustaining those powers or attributes which are in correspondence with superior intelligence; since they are not in relation to the mind alone, but intermediate between it and the external material world. Grant that vision is necessary to the developement of thought, the organ of it must be formed with relation to light. Speech, so necessary to the developement of the reasoning faculties, implies a complex and exceedingly delicate organ, to play on the atmosphere around us. It is not to the mind that the various organizations are wanted, but to its condition in relation to a material world.

The necessity of this delicate structure being admitted, it must be preserved by the modifications of sensibility, which shall either instinctively protect the parts, or rouse us into powerful and instantaneous activity. Could the eye guard itself, unless it possessed sensibility greater than the skin? Could it guard itself, unless this sensibility were in consent with an apparatus which acted as quick as thought? Could we, by the mere influence of pleasure, or by any cessation or variation of pleasurable feelings, be made alive to those injuries which might reach the lungs by substances being carried in with the air we breathe? Is there any thing but the sense which gives rise to the apprehension of suffocation, that would produce the instant and sudden effort which could guard the throat from the intrusion of what was offensive or injurious. Pleasure is at the best a poor motive to exertion, and rather induces to languor and indulgence, and at length indifference. To say that animals might be continually in a state of enjoyment, and that when urged by the necessities of nature, such as thirst, hunger, and weariness, they might only feel a diminution of pleasure, is not only to alter man's nature, but external nature also; for whilst there are earth, rocks, woods, and water, for our theatre of existence, the texture of our bodies must be exposed to injuries from which they can only be protected by a sensibility adapted to each part, and capable of rousing us to the most animated exertions. Take away pain, and take also away the material world, by which we are continually threatened with injury, and what, after all, is this

* Hume.

but imagining a future state of existence, instead of that in which mind and matter are combined? If all were smooth in our path, if there were neither rugged places nor accidental opposition, whence should we derive those affections of our minds which we call enterprise, fortitude, and patience?

Independent of pain, which protects us more powerfully than a shield, there is inherent in us, and for a similar purpose, an innate horror of death. "And what thinkest thou, (said Socrates to Aristodemus,) of this continual love of life, this dread of dissolution, which takes possession of us from the moment that we are conscious of existence?" "I think it, (answered he,) as the means employed by the same great and wise artist, deliberately determined to preserve what he has made."

The reader will no doubt here observe the distinction. We have experience of pain from injuries, and learn to avoid them; but we can have no experience of death, and therefore the Author of our being has implanted in us an innate horror at dissolution, and we may see this principle extended through the whole of animated nature. Where it is possible to be taught by experience, we are left to profit by it, but where we can have none, feelings are engendered without it. And this is all that was necessary to show how the life is guarded: sometimes by mechanical strength, as in the skull; sometimes by acute sensation, as in the skin, and in the eye; sometimes by innate affections of the mind, as in the horror of death, which will prevail as the voice of nature, when we can no longer profit by experience.

But the highest proof of benevolence is this, that we have the chiefest source of happiness in ourselves. Every creature has pleasure in the mere exercise of his body, as well as in the languor and repose that follow exertion; but these conditions are so balanced, that we are impelled to change, and every change is an additional source of enjoyment. What is apparent in the body is true of the mind also. The great source of happiness is to be found in the exercise of talents, and perhaps the greatest of all is when the ingenuity of the mind is exercised in the dexterous employment of the hands. Idle men do not know what is meant here; but nature has implanted in us this stimulus to exertion, that she has given to the ingenious artist—the man who invents, and with his hands creates, a source of delight, perhaps greater, certainly more uninterrupted, than belongs to the possession of higher intellectual powers, and far beyond any that falls to the lot of the minion of fortune.

We believe that every thinking person may have wherewithal in his own sphere to tutor him, and bring him to the temper of mind and belief which we would inculcate. Yet there is something peculiarly appropriate in the study of our own bodies. In chemistry we are so much the agents as to forget the law, and the law itself seems at least to intermit. But in the changes wrought in the animal frame, the directing power is uniform in its influence, and holds all in harmony of action.

We now learn without difficulty and without mystery, what is meant by organic and animal sensibility. The first is that condition of the living organ which makes it sensible of an impression, on which it re-acts and performs its functions. It appears from what has preceded that this sensibility may cause the blowing of a flower, or the motion of a heart. The animal sensibility is indeed an improper term, because it would seem to imply that its opposite, organic sensibility, was not also animal; but it means that impression which is referred to the sensorium; where, (when action is excited,) perception and the effort of the will are intermediate agents between the sensation and the action or motion.

We may sum up the inquiry into sensibility and motion thus:

1. The peculiar distinction of a living animal is that its minute particles are undergoing a continual change or revolution under the influence of life. Philosophers have applied no term to these motions.

2. An organ possessed of an appropriate muscular texture, and of sensibility in accordance with the moving instrument, as the heart, or the stomach, has the power of action without reference to the mind. The term *automatic*, sometimes given to those motions, conveys a wrong idea of the source of motion, as if, instead of being a living power, it were consequent upon some elastic or mechanical property.

3. There are sensibilities bestowed on certain organs, and holding a control over a number of muscles, which combine them in action in a manner greatly resembling the influence of the mind upon the body, yet independent of the mind: as the sensibility which combines the muscles in breathing.

4. In the last instance, a large class of muscles were combined without volition. But the whole animal fabric may be so employed, as in the instinctive operations of animals, where there is an impulse to certain actions not accompanied by intelligence.

5. A motive must exist before there are voluntary actions, and hence philosophers

have supposed that there can be nothing but instinctive actions in a new-born child. But we must distinguish here what are perfect at first, and what are imperfect and irregular, and become perfect by use and the direction of the will. The act of swallowing is perfect from the beginning. The motions of the legs and arms, and the sounds of the voice, are irregular and weak, and imperfectly directed. It is the latter which improve with the mind. From not knowing the internal structure, and the arrangement of the nerves, philosophers, as Hartley, supposed that an instinctive motion, such as swallowing, may become a voluntary act. Volition in the act of swallowing consists merely in putting the morsel within the instinctive grasp of the fauces, when a series of involuntary actions commence, over which we have no more control in mature age than in the earliest infancy. Swallowing is not a voluntary action, and the thrusting the morsel back with the tongue is like putting the cup to the lip. It is the preparation for the act of swallowing that is voluntary, but over the act itself we have no control.

It is an error to suppose that all muscular actions are in the first instance involuntary, and that over some of them we acquire a voluntary power. The power of volition over the muscles of the body is provided for by appropriate nerves, and no apparatus which is not supplied with that particular class of nerves can ever by any exercise or study become subject to volition. A child's face has a great deal of motion in it, very diverting from its resemblance to expression, before there can be any real motive to the action. It will crow, and make strange sounds, before there is an attempt at speech. But this gradual developement of intelligence and acquisition of power ought not to be called the will attaining influence over involuntary muscles; since, in fact, the apparatus of nerves and muscles is prepared, and waits for the direction of the mind with so perfect a readiness as to fall into action and just combination, before that condition or affection of the mind which should precede the action takes place. A child smiles before any thing incongruous can enter the mind, before even pleasure can be supposed a condition of the mind. Indeed, the smile on an infant's face is first perceived in sleep.

6. All the motions enumerated above are spontaneous motions belonging to the internal economy; but the external relations of the animal, the necessity of escaping from injury, or warding off violence, require a sensibility suited to those outward impressions, and an activity consequent on volition. Nothing less than perceptions of the mind, and voluntary acts, suited to a thousand circumstances of relation, could preserve the higher classes of animals, and man above all others, from destruction.

All these provisions proceed from an arrangement of nerves and muscles. The mechanical adjustment of the muscles and tendons is perfect, according to the principles of mechanics. The muscles themselves possess a different property; they are irritable parts; motion originates in them. This living property of contraction is admirably suited, in each particular muscle, to the office it has to perform. In some it is suitable that the muscles should act as rapidly as the bowstring on the arrow; in others the action is slow and regular; in others it is irregular, and after long intervals, according as the functions to which they are subservient require. The motions of the limbs, the motions of the eye, those of the heart and arteries, stomach, and bowels, are all different. This appropriation of action is not in the muscles themselves, but as they stand in relation to the nervous system, and the sensibilities which impel them.

We hope, then, by the course we have taken, that we have carried the reader to a higher sense of the perfection of the animal structure. We first drew him to observe provisions in the strengthening of the bones, the adjustment of their extremities to the joints, the course of the tendons, and other such mechanical appliances, proving to him the existence of intention in the formation of the solid fabric of the body. We have then explained how that motion is produced which was at all times familiar to him, but even the immediate causes of which he did not comprehend. We have in the last place shown him, that under the term life he has a still more admirable subject of contemplation in the adjustment of those living properties; in the sensibilities differing not so much in degree as in kind; and in their appropriation, both to the operations of the internal economy, and to the relations external, and necessary to safety.

It is not possible to contemplate these things without having the full proof before us of the power of the Creator in forming and sustaining the animal body. As a man with *gutta serena* may turn his eyes to the sun, and feel no influence of light, so may the understanding be blind to these proofs; and we may say with the celebrated Dr. Hunter, that he who can contemplate them without enthusiasm, must labor under a dead palsy in some part of his mind, and we must pity him as unfortunate.

Some More Notes on Mr. Nutt's Book on Bees.

[From the London Mechanics' Magazine.]

Sir,—In consequence of your inserting in your Magazine my remarks on Mr Nutt's book, I am emboldened to continue them;* but in doing so I shall endeavor to be as concise as possible.

We are told, "on rising early one morning in July, 1827, and walking into an apiary, as my custom then was and still is, I found that some malicious wretch had been there before me, and overturned a fine colony of bees." Is it not possible that the fine colony of bees, by being placed, as we are informed they were, on a square box, toppled off (to use an expression of Mr. Nutt's) of their own accord, without the assistance of "the malicious wretch?" Sir Joseph Banks, if Dr. Walcot can be relied on, was once the occasion of a similar accident when engaged in some interesting entomological pursuits.

Mr. Nutt, with "invention ever new," immediately converts the malice of this "malicious wretch" into a great benefit, for it leads to the invention of a bee-hive at least equal in value to his "matchless one." It is called the inverted hive, though, to a plain bee master like myself, to turn a bee-hive topsy-turvy appears an absurdity. Indeed, Mr. Nutt, when enumerating his objections to the practice of driving bees, acknowledges it to be so. He says they are turned topsy-turvy, and describes it very truly as a "strange unnatural position," though when descanting on the merits of his own invention it becomes instanter the very best possible position. Mr. Nutt must, however, have overlooked one inconvenience arising from it—at least, so it appears to me. The cells in the comb, as built by the bees in the hive, have an inclination so great as to admit of being completely filled with honey, without requiring to be sealed with wax, which is never done, excepting the honey is intended for use in winter. By turning the hive topsy-turvy, as in this unique invention, if there be any honey in the cells at the time the operation is performed, (which is extremely probable, as it is recommended to be done between the months of March and October,) every drop will run out, and lodging at the bottom of the hive, will probably destroy the greatest part of the bees, and those not absolutely killed will be so daubed with it as never after to be able to fly—an objection, by the way, which Mr. Nutt avails himself of, and strenuously urges when condemning the storying practice. There is another very powerful objection to this topsy-turvy hive, which must be obvious to every one. When a hive is placed, as it usually is, on a stand, by carefully lifting it on one side, the stand can be easily cleaned (which Mr. Nutt very properly recommends to be frequently done); but how is such an operation to be performed when the hive is turned topsy-turvy? It is impossible. Every thing must fall to the bottom of the hive, where it will accumulate and become an intolerable nuisance, there being no mention made of any semi-lunar hole through which the filth might be extracted. Besides these objections, the expense of fitting up one of these topsy-turvy hives must be so enormous as to counterbalance any advantage to be derived from it. The only part, after all, of this invention, to which Mr. Nutt has any claim, is the topsy-turvy part—all that relates to the glasses is entirely the invention of the late Mr. Wildman. I purchased some years ago, at the shop of Mr. Wildman, just above Middlerow, Holborn, a straw hive, with a flat wood top to place glasses on, with proper apertures cut for the bees to work through into them, exactly as I understand to be the case in Mr. Nutt's inverted hive; and I now get excellent straw hives, made in a similar manner, at a less price than 4s. There are boxes made on the same construction, I believe, by Mr. Milton, of Marylebone street, who also furnishes the requisite glasses. It is farther worthy of observation, that Wildman gives in his book plates of all his hives —*these hives with glasses on them among the number*—and that Mr. Nutt mentions in his preface that some friend had made him a present of this very book.

We come at length to the most prominent of all Mr. Nutt's inventions, that invention which, according to his distinguished patron, the "learned lord," is "a more ingenious contrivance" than was ever "put into operation by any other man." It is called the "observatory hive," afterwards the "grand hive;" and as if neither of these titles was sufficiently distinctive, ultimately the "blessed hive."

> "By this bless'd hive our ravish'd eyes behold
> The singing masons build their roofs of gold."

"Singing masons!" I have long and anxiously studied the sublime mysteries of masonry, and obtained the very highest degrees conferred by our grand professors; but this

* We think our correspondent's remarks are written in the spirit of truth, and therefore willingly insert them; which we do the more readily, that though ample time has been afforded to Mr. Nutt and his admirers to refute the former strictures of the same writer, they still remain unrefuted in every essential particular—the friendly efforts of Mr. Booth and K. notwithstanding.—[Ed. L. M. M.]

is the first time I ever heard of its being a characteristic of a good mason to sing at his work. No: such things are never thought of by any of my brethren until they have ceased labor, and are partaking refreshment. I do not deny that some unworthy characters may be found in so numerous a body as my craft consists of. By tradition, we know that two pestilent fellows were engaged in the building of Solomon's Temple, and the atrocious act they committed is still deeply deplored by all good masons. I apprehend the idea that masons mis-spend their time in singing was communicated to Mr. Nutt by his noble patron the "learned lord," who, from his acquaintance with the ancient authors, has no doubt read the following story, which is to be found in Thomas Bozius de Signis Ecclesiæ: "How certaine theeves, having stolen the silver boxe wherein the wafer gods used to lye, and finding one of them there, being loth, belike, that hee should lye abroad all night, did not cast him away, but laid him under a hive: whom the bees acknowledging, advanced him to an high roome in the hive, and there in stead of his silver boxe, made him another of the whitest waxe: and when they had so done, in worship of him, at set houres they sung most sweetly beyond all measure about it: yea, the owner tooke them at it at midnight, with a light and all. Wherewith the bishop being made acquainted, came thither with many others; and lifting up the hive, hee saw there neere the top a most fine boxe, wherein the host was laid, and the quires of bees singing about it, and keeping watch in the night, as monkes doe in their cloisters. The bishop, therefore, taking the host, carried it with the greatest honor into the church; whither many resorting, were cured of innumerable diseases." The conclusion which the author necessarily inferreth thereupon is better than all the rest: "Ex his necesse dicamus in eucharistia verum Christi corpus esse."

This "blessed hive," Mr. Nutt observes, "*at first sight* may probably appear a piece of complicated machinery." But what at second sight? I will venture to answer for every person who has read or may read Mr. Nutt's description—"just as complicated as before!" I have read the description of every steam engine which has appeared in the Mechanics' Magazine ever since its first publication, and, with the assistance of the accompanying plates, could always understand the machine described as well as a person not being a professed or scientific mechanic could be expected to do; but although I have read the description of the "observatory hive" ten times over, I am still as much in the dark as to what constitutes its peculiar excellence, as I was before I possessed Mr. Nutt's book. I am almost tempted to believe Mr. Nutt did not intend that the reader should understand his description; it has certainly as much the air of a deliberate piece of mystification as any thing I ever met with. I must, however, return my thanks to Mr. Nutt for one piece of information he has given of *great importance*, which is, that in writing the description of this "grand," this "blessed" hive, he did not consume the midnigh toil, but used "a *tallow* candle of his *own* making, stuck in a *telescope* candlestick, with a *square* foot!"

The directions for stocking with bees this observatory hive are too diffuse to remark on; but I cannot avoid noticing the pertinacity with which Mr. Nutt maintains his assertion, that two hives of bees will quietly unite on being put together, and become as one family. The observatory hive, in summer, consists of two distinct families—one inhabiting the topsy-turvy part, and the other what is properly the observatory or part to peep into. A piece of mechanism resembling the telescope candlestick, used by Mr. Nutt when writing the description of it, keeps the two families completely separated during the summer; but on a slide being withdrawn in the autumn, the bees in the observatory part are said to quit their summer residence and join their topsy-turvy neighbors, who, strange to tell, quietly unite with them: the united bodies continuing henceforward, according to Mr. Nutt, to labor as one family. I have before observed, and again repeat, that they will do no such thing without fighting. Their combats, in such cases, are carried on with all the animosity of two hostile tribes of Indians—a fact well known to every person who is the least acquainted with the habits of bees.

The only farther notice I shall take of Mr. Nutt's "grand" or "blessed" hive, is to mention that the thermometer, which he had previously taught us to believe was an indispensable instrument in the humane management of the honey bee, is dispensed with in this as well as in the topsy-turvy hive. Are we to infer from this that it is a matter of no consideration whether the bees in either of *these* hives are treated humanely or not?

I am now come to the chapter on fumigation, which appeared in the Mechanics' Magazine,* by which I was enabled, previously to possessing Mr. Nutt's book, completely

* See page 129, vol. vi. of the N. Y. Farmer (1833.)

to demolish every pretension he could possibly have to call himself the discoverer of that process, although he arrogates to himself all the merit of it. I refer to my letter inserted in the Mechanics' Magazine of the 11th January last, in which I proved that he had copied the whole of his directions how to perform the operation, *verbatim*, from the work of Mr. Thorley, which no other person, to use the language of the learned lord, "save Mr. Nutt," would have done, without mentioning the source from whence he obtained the information. But this is not all.

I am now able to prove that fumigating bees was a common custom 150 years before even Mr. Thorley wrote his book. I possess an elaborate work, written by that profound scholar and learned physician, Dr. John Gerard, called his "Herbal," my edition of which was printed in 1597, and I shall extract from it what is said respecting the very fungus Mr. Nutt uses for his *newly* discovered process of fumigation. From this it will appear that Mr. Nutt and his apiarian pupils, both patrician and clerical, have been using a very dangerous article. The Doctor's words are, "It is called fungus orbicularis, or lupi crepitus; some do call it fungus lucernarum, in English fusse balls, pucke fusse, and bull fists, which in some places of England they use, being set on fire to kill or smolder their bees when they would drive the hives, and bereave the poor bees of their meat houses and lives, for which purpose it fitly serveth. In form they are very round, sticking and cleaving unto the ground, without any stalks, at first white, but afterwards of a duskish color, having no hole or breach in them whereby a man may see into them, but being trodden upon do breake forth a most thin and fine powder, like unto smoke, very noisome to the eies, causing a kind of blindnesse, which is called poore blinde or sand blinde; for it has been often seen that divers have been blinde ever after, when a small quantity hath been blown into their eies."

Mr. Nutt, at the commencement of his 14th chapter, admits that, in the previous one, he had been to sea without a pilot—the meaning of which nautical phrase, if I understand it, is that he had been writing on a subject of which he was entirely ignorant: an admission which he might have made with equal propriety at the commencement of every chapter in his book. The opinion which he entertains, that the old queen bee leaves her hive with the first swarm, I do not myself entertain, although Dr. Bevan does; but as the Doctor, in his work on bees, makes no mention of having made any experiment himself to ascertain the fact, I do not feel bound to pay much attention to the Doctor's dictum, although I entertain a high respect for him. Mr. Nutt has evidently borrowed the idea from Huber, whose work on bees was translated into English so long ago as 1808; and although he has positively asserted that he never obtained any knowledge of bees from books, many persons like myself will be incredulous, knowing he could avail himself of the discoveries of Huber twenty-four years before his own book was published. My incredulity is increased by the praise he lavishes on the discovery of Shirach, which he tells the learned lord he had proved satisfactorily to his own mind, although, from his ignorance of every thing respecting the true economy of bees, I believe him incapable of performing such an experiment. I was convinced he had read Huber when I first addressed you; and when I knew nothing of his book but through the medium of the Mechanics' Magazine, by his using the following expression, "How is the queen bee impregnated?"—which is copied from Huber. Mr. Nutt describes the queen's leaving the hive as follows: "She leaves the *royal cradle impregnated* with the royal larvæ, and withdraws from the hive, unwillingly,—no doubt." If there be such a degree of unwillingness on the part of the old lady to withdraw from the hive, why does she not wait a few days, when, if I understand Mr. Nutt's expression, the impregnation of the royal cradle would have arrived at that stage which, by accoucheurs, is called parturition, which would have obviated the necessity of the journey? The laborious experiments of Huber, to ascertain whether the old queen departed from the hive with the first swarm, were undertaken at the suggestion of the French naturalist, Bonnet, to whom all Huber's letters detailing the result of them are addressed. Bonnet, in a very long letter which he wrote Huber at the time, urged him in the strongest language never to mutilate the queen, but to mark her on the thorax conspicuously, with a varnish that would resist humidity, and produce no injurious effects. This advice Huber, however, pertinaciously rejected; for, in every experiment he gives an account of, he invariably deprived the queen of one of her antennæ. Now, Bonnet, in giving such advice to Huber, must have been well aware that by mutilation the habits of the insect would be altered; indeed it is so, if the creature is only deprived of a limb—how much more, then, when deprived of such an important organ

as the antennæ, which he allows are either the organs of feeling or smelling. He admits, also, that depriving a queen of *both* antennæ was productive of most singular effects. From the moment of its being done, there was a very great alteration in her conduct; she was sometimes quite motionless, at others she traversed the combs with great rapidity, and if she wanted food from the working bees, she directed her trunk for the purpose of receiving it with an uncertain kind of feeling, sometimes towards the bees, and sometimes against the combs; and if her trunk did reach the mouths of the bees, it was by chance. She also appeared tormented with a desire to leave her habitation, and he found it impossible to keep her in the hive: neither would the bees follow her in this mutilated state—indeed, they appeared perfectly indifferent what became of her. If this be the consequence of amputating both the antennæ, why then persist in mutilating the insect at all, particularly when in direct opposition to the advice of the person for whose satisfaction the experiments were undertaken? If such effects were produced by depriving the insect of both antennæ, is it not natural to suppose that the amputation of even one must produce some great alteration likewise in the insect's conduct, such as being tormented with a desire to leave the hive? I am convinced it does create this desire, and that it is carried into execution the first moment she can induce a swarm to accompany her. My opinion is strengthened by what Huber says, that his bees always swarmed when he had no expectation of their doing so; for it always happened after his secretary and himself had been engaged in experiments with them, and had gone away. I never shall be of Huber's opinion, until I hear of a series of experiments conducted in the manner suggested by Bonnet, and attended with similar results to those recorded by him. He admits that, when in a perfect state, the bees will never allow, for any length of time, more than one queen to remain in a hive, in consequence of the natural animosity that exists between them; although when deprived of one antennæ each, they will permit two, and the queens cease to retain their usual enmity to each other.

It is absolutely astonishing with what facility Mr. Nutt, according to his own account, has been induced to adopt the idea of the old queen leaving her hive with the first swarm, for the following is an account of the whole of his researches on the subject: he has, he says, sometimes on the evening a hive has swarmed—sometimes on the second, at other times on the third, evening afterwards—fumigated the hive, dissected and examined the combs and queen cells minutely, and whenever he has found a queen it has always invariably been a young one; but in general, he has only found a royal cell, just ready as it were to give birth to a successor to that which had left the hive. In this easy and expeditious way does Mr. Nutt solve a problem, which occupied the indefatigable Huber and his equally indefatigable secretary many years. Even in this experiment, as it is called, trifling as it is, he is incorrect. He says, the queen withdraws from the hive, leaving the royal cradle only impregnated. I once had a swarm that settled on a post, and in hiving it the queen was killed; the bees in consequence returned to the hive. The same evening the usual noise, which is made before a second swarm, was made, and I distinctly heard it from different parts of the hive at the same time—a proof, that instead of the royal cradle only being impregnated, there were two queens actually then in existence; the hive swarmed early the next morning. Reaumur, who studied the habits of bees many years, and is called, from the great knowledge he acquired of the insect, the historian of bees, did not believe the old queen left the hive; and Huber admits he never in any other instance found him inaccurate. An ancient author, named Publius Virgilius Maro, has recorded his opinion against Mr. Nutt very decidedly in the following words, as rendered by Dryden:

> "The youthful prince, with proud alarm,
> Leads out the vent'rous colony to swarm."

The same author informs us that the evil of bees swarming, which Mr. Nutt now so feelingly deplores, existed in his time, and recommends, when such a distressing event occurs, to mix with tinkling brass "the cymbal's droning sound;" and as I am resolved such a laudable practice shall not fall into desuetude through any neglect of mine, and not possessing any cymbals, I use an instrument, probably unknown to my ancient author, yclept a warming-pan, which I find from experience answers equally well. Butler, whose work, the "Feminine Monarchie," was translated into Latin in 1671, believed a young queen led the first swarm. John Geddie, Wildman, Bonnor, Mr. John Hunter, and many other authors, were of the same opinion. I do not possess the works of Aristotle or the Elder Pliny, and therefore cannot avail myself of those great authorities. It very frequently happens, when a swarm issues from a hive it returns almost immediately. This is occasioned by

the queen falling to the ground or being unable to fly. On being missed by the bees they return; and in general she can easily be found on the ground with a small cluster of bees surrounding her; and if examined, she will be found to be a young one, unable to fly. The circumstance is noticed by many authors—I know even of instances that have occurred this year. Mr. Nutt appears to be of opinion that the queen is an amalgamation of both sexes. He doubts whether there is any male bee, and says the fact is the queen is both virgin and mother; although, according to his own book, the queen carries on the business of procreation in what he calls the Pavilion! Afterwards he says there is no copulation. If I understand any thing of my own language, both words have the same meaning. When the learned lord asks him how generation was brought about, he finds himself at such a nonplus as to be incapable of an answer, but turns the discourse, and says he is confident neither drones nor working bees lay eggs. No person supposes the drone does; but Huber is of opinion that there are fertile working bees. Mr. Nutt says that even the indefatigable Huber never discovered the precise way in which the queen bee was impregnated, but imagined it took place in the air, and that he *modestly* acknowledged he never witnessed the act of copulation. Mr. Nutt should have omitted applying the term *modest* to such a man as Huber, for there may be persons who will draw a comparison between the modesty of Huber and himself, and I will not say he would benefit by the comparison. Huber not only supposed the act of coition took place in the air, but that the drone died immediately after it was effected. I believe his ideas are correct. It is well known what takes place in the air with the common house fly; the same thing takes place with the white butterfly and the common May-fly. The male of the latter dies shortly after coition, as Huber conjectures is the case with the drone; for the effect is the same as when a bee uses its sting, death being the consequence. Mr. Nutt makes strange assertions; he says the royal larvæ are *always* in existence. In another place he states, that if it were not for the great heat caused by the drones, that are never seen but from May until the end of August, the young larvæ of all the bees would undoubtedly perish. But how do the drones themselves come into existence? In the very next page he asserts, that the bees of a well populated hive will always bring to perfection the queen's eggs that have been deposited in the cells after the total destruction of the drones. Shortly afterwards a new light opens on Mr. Nutt, and he now doubts the accuracy of his opinion, so positively expressed in his conversation with the learned lord, that the queen bee was both virgin and mother. In short, he says, "I now see no objection to Huber's theory, although there is no direct proof of the copulation of the queen with the drone." All apiarians agree—indeed it is impossible to deny—that there are male and female in a hive of bees. Mr. Nutt very shrewdly observes, that although no person has ever observed the act of coition, it is, no doubt, performed in a way consistent with the law of nature! A very candid admission.

It was my intention to have made some remarks on Mr. Nutt's pretensions to entomological knowledge, but find, on a careful perusal of his book, that he is absolutely ignorant of every part of the science. I now close my remarks on his book, requesting your acceptance of my grateful acknowledgments for the insertion of them in your very useful Magazine.

I am, Sir, yours, &c. J. P. T.

June 24, 1834.

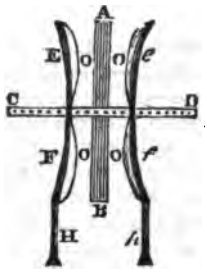
Application of the Principle of a Balance.

[From the American Journal of Science and Arts.

The principle of a balance is a powerful one when ingeniously and judiciously applied to mechanics and the arts. Its applicability is universal. There are few if any machines now in operation that are not dependent upon this principle, or to which it cannot be beneficially applied. Look at the numerous machines employed in the various manufactories of Europe and America: how diversified, how multiplied, and how complex their operations; what a consumption of power is required to work or move them; what expense is incurred, and how great is their performance; nevertheless, how few are the parts, and simple the motions, absolutely necessary to answer, if not overrun this performance. Indeed, what cannot man do on the principle of a balance, and what can he do without it. With it, with liberty to exert his power, he might displace the world; and without it, how limited would be his influence in mechanics and the arts, and how small his accessions of power and profit derived from that source. I conclude my premises (as effects balance causes, and causes effects,) by suggesting that some of the greatest discoveries yet to be developed to the world may, in all probability, be founded on the powerful and universal principle of a balance, which pervades not only me-

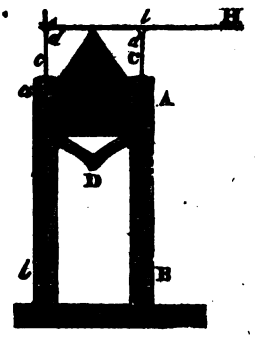
chanics and arts, but every part of the universe.

Fig. 1.



1. Application to Milking.—Fig. 1 represents a machine for milking. A B represent a light block, five inches long, three wide, and an inch and a half thick. C D represent a ruler-like piece of wood, or metal, five inches long, one third of an inch thick, and two thirds wide, perforated with holes at every sixth of an inch from end to end. This piece, C D, is to be firmly inserted, and fastened at right angles in the middle of the block A B. E F, *e f*, represent two similar, strong, light, thin boards, a little curved from their centre, each five inches long, three wide, and half or two thirds of an inch thick. H *h* represent the handles, which can be formed in connection with the boards, or attached separate. The boards are to have each one mortise, cut through its middle, of a sufficient size for the easy and regular motion of the ruler-like piece C D. Holes are to be made at right angles through the centre of each of these mortises, corresponding with those in the piece C D, so that by means of small pins or screws, these boards, E F, *e f*, can be moveably hung nearer or farther from the block A B, as required. o o o o, represent the spaces between the block A B, and boards E F, *e f*, which the teats are to occupy to be milked. The sides of the block A B, and the inner sides of the boards E F, *e f*, are to be lined with leather, or some other soft substance, stuffed with cotton, &c. so as to be elastic and press easy against the teats and not injure them. This lining should be harder, and project farther, the nearer it comes to the upper sides of these boards and blocks; so that when the pressure is given, it will commence at the upper parts of the teats and gradually increase downwards, till all the milk is forced out. Instead of this stuffed lining, springs, spiral wires, or some other elastic substance, may be used; perhaps springs are best. To work this machine, it is to be supported by the hands by means of the handles H *h*, in such a position that the teats will hang down between the block and the boards at o o o o, two teats each side of the piece C D. Both handles are to be moved inwards and then outwards, either fast or slow, so that the operation of milking can be performed or regulated at pleasure. When the handles are moved inwards, the two nearest teats to the milker will be milked; when moved outwards, the two farthest; and thus, as the motions can be so quick, there will almost flow four streams, till the operation is performed. Instead of communicating the pressure on the outside, it may be applied on the inside by altering the construction a little. This machine is applicable to other purposes allied to the operation of milking. The construction, dimensions, weight, and quality of the materials are variable, but the principle of operation is the same.*

Fig. 2.



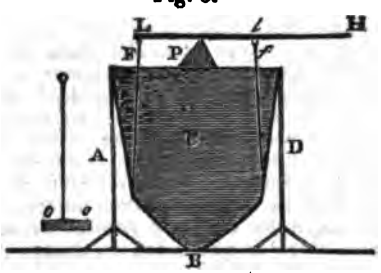
2. Application to Pumping.—Fig. 2 represents a balance suction or forcing pump, for water or air, wherein there is no loss of motion. W represents a body of air or water. A B, *a b*, represent two similar hollow cylinders, whose lower ends are inserted perpendicularly, equidistant, and parallel in the body W of air or water. P represents a pivot, which firmly connects the top of the cylinders, and across which the balancing lever L *l* is to be moveably hung and poised. H represents the handle of the lever L *l*. C *c* represent two similar piston rods, whose upper ends are moveably hung to the lever at *d d*, and to whose lower ends are attached either pistons or valves, as it is designed for a suction or forcing pump. D represents the pipes of both cylinders, united to convey off the air or water. It can be conveyed off separately. This is operated by an upward

* Having stated to the author some doubts as to this new process of milking, we have received his assurance that he has proved it practically, and that he desires its publication.—[Ed.]

and downward motion of the handle H. Any equal number of pumps, either suction or forcing, of equal dimensions, can, by being connected on this principle of a balance, be worked or moved by one handle. This application is susceptible of numerous modifications.

3. Application to Churning.—Fig. 2 will serve to illustrate its application to churning. A, B, *a b*, represent two churns; C *c*, their dashers or piston-rods; L *l*, the balancing lever; H, its handle; P, its pivot, which connects them the same as the cylinder A B, *a b*. It is worked by an upward and downward motion of the handle H. This construction may be modified into a forcing or piston churn, by having a communication at the bottom between them, to force the cream alternately from one into the other. Instead of two churns, one churn resembling those commonly wrought by a crank, with a piston through the middle, and an aperture through that, would answer the purpose. I am of the opinion, that, in churning, the cream would gather sooner, and form butter, by being powerfully forced alternately through small apertures, than by any other means, unless it be by adding some substance or composition that will immediately fetch it. Instead of the cream's being forced from one churn into the other and backwards, constantly, a small wheel full of holes, (the lids of the churns being made tight and fast,) might be attached to the lower end of each piston-rod or dasher, and made to operate up and down, and answer the same purpose. or a better than the former method.

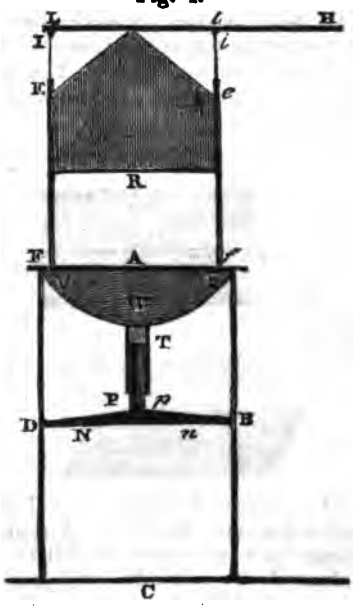
Fig. 3.



4. Application to Washing.—Fig. 3 represents a washing machine. C represents the cistern, which can be lined with rollers on the two sides A D, to hold the water and the clothes to be washed; three feet high and three wide; A B D, its frame; P, the pivot; L *l*, the balance lever; H, its handle; F *f*, the rods on which the washers, beaters, or rollers, are hung; *o o* represent a beater, &c. attached to its rod F or *f*. This machine is operated by the upward and downward motion of the handle H, and can be variously modified.

5. Application to Fulling.—Fig. 3 will serve to illustrate its application to a fulling-mill or machine. There are two constructions to this application: a vertical and horizontal. Fig. 3 enlarged will represent the vertical one. The horizontal one is nearly the same as the vertical, only that the lever and rods have a horizontal motion, and the cistern must be modified a little to answer it. In both constructions the operating power is to be applied to the handle H.

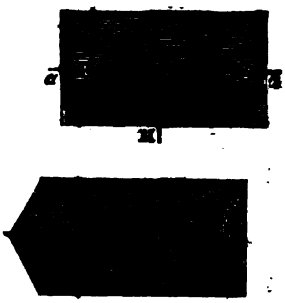
Fig. 4.



6. Application to an Aerostatic or Hydrostatic Press.—Fig. 4 represents an aerostatic or air, or a hydrostatic or water press: A B C D, its frame; W, the air or water cistern, which in shape resembles the segment of a hollow sphere or hemisphere; T, a strong hollow cylinder inserted in or attached to the bottom of the cistern; N n, the follower, a strong bar, fitted to move up and down in the sides D B of the frame. To this follower is attached the piston P *p*, which is exactly fitted to move up and down in the cylinder T, so as to prevent the escape of air or water. The pressure of this press is given between the follower N n, and the side of the frame C. E F, *e f*, represent two hollow pipes, whose lower ends are tightly inserted into the cistern W. V *v*, two valves

that exactly cover the lower ends of these pipes, and open sufficiently into the cistern. R, the pivot of the operating lever, which connects the top of the pipes; L *l*, the operating lever; H, its handle; I *i*, two rods that move up and down in the pipes, whose upper ends are moveably hung to the lever L *l*, and to whose lower ends are attached wheels or pistons with valves in their centre, opening downwards, exactly fitted to move up and down, and not allow the escape of air or water. To give the pressure either by air or water, it is admitted into the top of the pipes, passes through the valves in the wheels and the valves V *v*, until the cistern is full; the handle H is then to be worked, and the water or air will force down the piston P *p*, and consequently the follower N *n*, and press whatever is between it and C. To take off the pressure, the air or water can be let out of the cistern. Pistons might be used in the pipes. This press is susceptible of numerous modifications and applications.

Fig. 5.



1. Application to Printing.—Fig. 5 represents a printing machine. A represents an oblong table or frame, set full of types, and balanced on its axle E *e*, which supports it at *a a*, moveably in two upright standards. H represents the operating handle; M, a heavy or solid, oblong, triangular block, as wide and long as the table, over which it is to be firmly hung, so that one of its angles will run parallel and laterally with its axle E *e*. The two sides of the block M, immediately over the types or against which they will press, when the handle H is operated, must be lined with some elastic substance, in order to give a good impression. The types are to be inked by inking rollers, and the paper applied by hand or machinery. Instead of the table being moveably hung, and the block fixed, it may be reversed: the table fixed and block moveably hung. Instead of the block being triangular, and table flat, the block may be flat, and the table triangular. Every motion of the handle H, either upwards or downwards, will give an impression. H. Strapp.

East Nassau, Rensselaer co., N. Y., April 28, 1834.

Improvement in Railways.—It has been resolved to make trial, on the Birmingham railway, of slabs of slate fixed in a bed of concrete, as a substitute for the usual stone sleepers. We have since been informed that, in an experiment previously made on the premises of Messrs. Cottam and Hallen, in the presence of the engineer and several of the directors of the Company, it was found, by the hydraulic press, that a cubic inch of slate will sustain a pressure of three tons and a half, and that consequently slate of an inch and a half thick is more than equal to any pressure which it can be required to support on a railway. The saving in expense, if slate is ultimately adopted, will be at least one half.—[Engl. pap.]

American Journal of Science and Arts, for July, August, and September.—The number before us is in no wise calculated to diminish the well-earned reputation for ability which this journal has so long possessed. Amid its varied contents, we have read with the greatest pleasure the Report on the projected Geological and Topographical Survey of the State of Maryland. This report is intended only as an introductory account of the geology and hydrology of the State, with a view of inducing the Legislature, in its coming session, to authorize their more thorough investigation. There is but little doubt, we learn, but what a liberal appropriation will be made, to bring to a completion what the authors of this report have so successfully commenced. But why is it, we would here ask, that while such States as Massachusetts, Maryland, Virginia, and Tennessee, have either completed or are now carrying on surveys of a like character, our own State has done nothing towards a developement of her physical geography? As regards its "mineral constitution," we may safely say, that with the exception of the iron at Ramapo, and the salt at Salina, there is scarcely any thing known. That our State is eminently rich in wealth of this nature, from which might be drawn a fruitful source of revenue, there is no reason to doubt. Our public as well as individual interest require that that scientific information on the subject of our agricultural and manufacturing resources, which can only be obtained by means of surveys like the above, should be furnished without delay.—[Railr. Journal.]

The Mechanics' Magazine and Register of Inventions and Improvements is published by the Proprietors, D. K. Minor and J. E. Chasson, at No. 38 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or in $3 per annum *in advance*.—Josiah Kinnutt (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

Volume IV.] FOR THE WEEK ENDING OCTOBER 25, 1834. [Number 4.

Seventh Annual Fair

OF THE

AMERICAN INSTITUTE,

HELD AT NIBLO'S GARDENS,

October, 1834.

It is with no ordinary satisfaction that we again bring before the notice of our readers some of the most useful and important inventions, improvements, and displays of American ingenuity and industry, exhibited at this annual fete—an exhibition in every way honorable to us as a nation, and calculated by the competition it offers, and the rewards it bestows, to render us able in a short time to vie in all our manufactures and mechanical skill with any nation on the face of the globe.

America has great reason to be proud of her numerous institutions for fostering talent and ingenuity, her seminaries of learning, and her philanthropic institutions in every section of the Union, but to none will posterity be more indebted than the institution now under our notice. It promotes a taste for the cultivation of the arts and sciences—gives a spur to industry among all classes—and has been the means of bringing into notice individuals of modest merit, who without a similar institution would have known full well

> how hard it is to climb
> The steep where Fame's proud temple shines afar,
> ——how many a soul sublime,
> Has felt the influence of malignant star—
> And waged with fortune an eternal war,
> Checked by the force of pride, or envy's frown,
> Or poverty's unconquerable bar."

It offers, too, by its annual exhibition, by the meeting of so many of the ingenious and scientific of our land, an opportunity for the interchange of ideas, which must afford them great gratification, and when guided by those feelings of patriotism which will ever be found predominant in the breasts of men of talent, must be productive of great benefit to our country.

We are gratified to learn that the number of visitants this year quite equalled that of any former one, and we most cordially wish that this, as well as institutions of a similar nature, may "go on and prosper."—[Ed.]

List of articles exhibited.

Steam Engine and Sugar Mill—Cylinder, 2½ inches bore, 4½ inches stroke; walking-beam, 13½ inches long, from centre to centre; connecting rod, 13½ inches long; crank, for connecting rod, 2¼ inches long; fly wheel, 16 inches diameter; air pump next to cylinder; force pump in the centre; injection and feed cocks between the two centre standards; feed pipe from boiler to feed cock; boiler, 22 inches long, 13 inches diameter, of copper.

Spur wheel for sugar mill, 16 inches diameter; pinion, 1¾ inches diameter; 3 rollers and stands for sugar mill; rollers, 5½ inches long, 3¼ inches diameter; the driving wheels for rollers are the same diameter from the pitch line as the rollers. This mill is connected with the engine by a coupling attached to the spur wheel, which works in the pinion attached to the fly wheel of the engine.

The Draught and Model of a Ship, 420 tons, drawn by C. G. Selfridge, of Boston, representing 4 different plans of the ship. 1st, Sheer plan, which represents the ship as looking upon her broadside; shows the place for the masts, the shape of the cut-water, rudder, &c.; also, of the section lines, diagonal lines, bearding line, throat of the floors, &c. 2d, A half-breadth plan, which represents the ship upside down, shows the shape of all the water lines; main and top breadth, &c. 3d, Square body plan, representing all the square frames of the ship in their proper shape and place, with the diagonal section and water line struck upon them, also the height and length of the main transom, with the upper and lower edge of all the other transoms, struck across the frames to lay them down in the half breadth transom place. 4th, Cant body plan, representing all the forward and after frames canted into their proper places, showing the shape of all the cants, and the fashion piece, the size of all the transoms, and the place for the heels of the cants in the dead wood. Dimensions of ship—126 feet on deck, 26 feet beam, 19 feet deep.

The model was made to order, or the beam would have 28 instead of 26 feet.

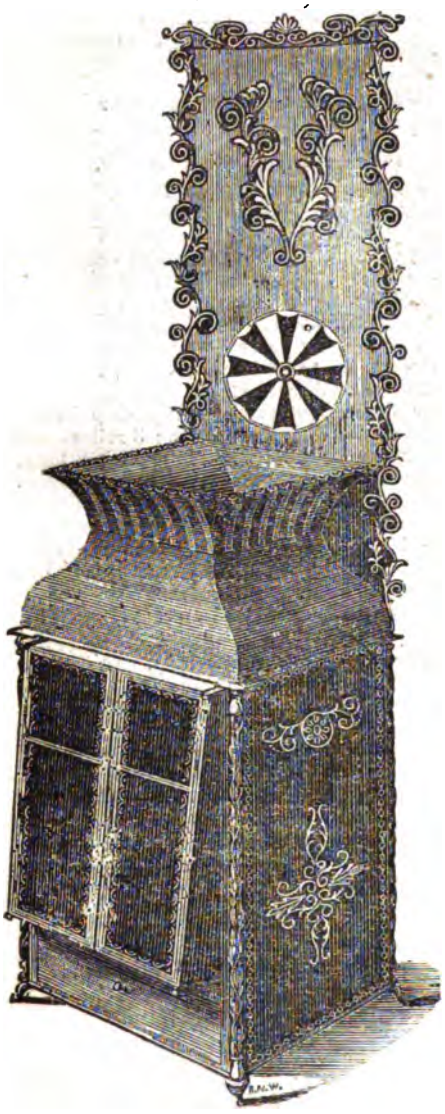
Likewise, the Model of a Steamboat, for sea, with spandings under the guards, for the double purpose of preserving the guards from the force of the sea, and making the boat more buoyant. Made by Selfridge. Dimensions—151 feet on deck, 24 ft. beam, 48 ft. from out to outside of guards, 10½ ft. deep, wheel 22 ft.

Stoves, &c.

H. Nott & Co. 1st premium on anthracite coal Hall and Cooking Stoves—a silver medal.

J. L. Mott, 2d premium for anthracite coal Cooking Stoves—a diploma.

W. Naylor, 2d premium for anthracite coal Hall Stoves—a diploma.



Naylor's Newly Invented Hot-air and Self-ventilating Stove—an entirely new article, embracing principles which the inventor has never known to be applied to any other stove; they are recommended with the greatest confidence, and warranted to perform well in every respect, or no pay demanded. Heat can also be applied to other rooms from the same stove when required. The demand for them last year was greater than could be supplied in time, and they have undergone a very great improvement this year, both in utility and appearance, which is a farther recommendation.

J. L. Mott, 1st premium for Office Stoves—a diploma.

James Wilson, 2d premium for Office Stoves—a diploma.

N. Whitman, 1st premium for Parlor Grates—a silver medal.

Edward Smylie, 2d premium for Parlor Grates—a diploma.

B. H. Folger, for anthracite Globe Stoves—a diploma.

Platt & Treadwell, Albany, Parlor Stove for wood—a diploma.

F. Van Tassel, for a Cooking Stove—a diploma.

Joel Curtis, for a coal Cooking Stove—a diploma.

Richards & Damerel, Cooking and Office Stoves—a diploma.

H. S. & J. S. Gold, 1st premium for Portable Bake Ovens—a diploma. This oven is constructed for preventing the loss of heat, being made double, (the material of tin or other thin metal plate,) with a distance between the two of from three quarters to an inch, so that between the two casings on the top, and on all sides, there may be confined air. This construction of the oven gives it firmness and durability.

The furnace is in the centre, between the doors or ends of the oven, passes through it, is put in at the top, and projects a little below the bottom. The fuel is put in at the top, which has a cover, (as represented in the first cut;) the draught enters (as represented in the same cut) in front, just under the bottom. The sides of the furnace are represented in the second cut, by the two lines near the centre. The circle represents the smoke or gage pipe, which ascends behind the oven. The furnace is about two inches thick, is nearly as wide as the oven, so that it divides it into two parts: it holds about eight quarts of coal, which is sufficient to bake at least *thirty-two loaves* of bread. To prevent the heat from operating unequally, there is a contrivance introduced for regulating the heat, by producing what is called by the inventor, "the circulation of heated air." Those several pieces running parallel with the furnace, and near it, represent a *vertical partition*, in so many pieces. The air between this partition and the furnace becomes immediately heated; it then rises, of course; and as each piece of the partition is set back towards the furnace a proportionable distance, (as is seen in the cut,) the heated air will enter between the several shelves and pass towards the door over the articles on one shelf and under those on the other, by which the heat will be absorbed, so that the air will become cooler when it reaches the door, where, by preponderance, it will ascend through the space (represented in the cut) to the bottom, when it will be re-heated, and so on. This contrivance for producing circulation has never before been known, and from this the oven derives its chief advantage, as it will operate equal-

Fig. 1.

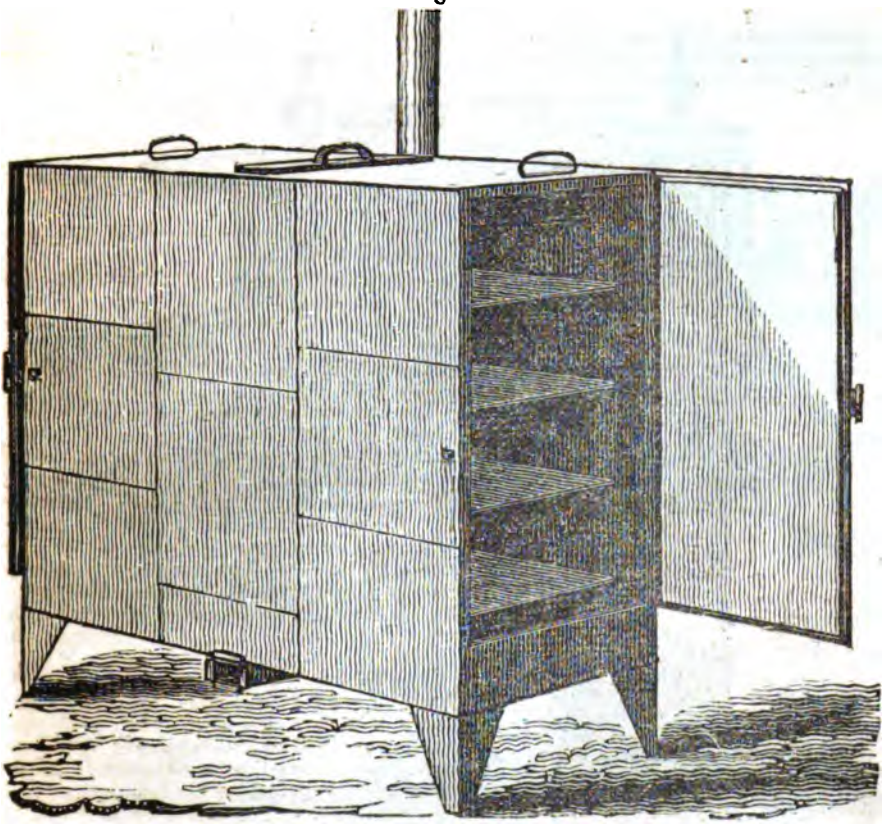


Fig. 2.

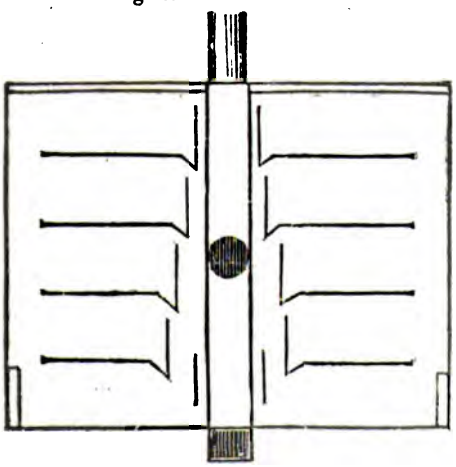
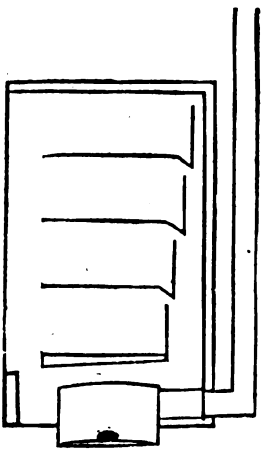
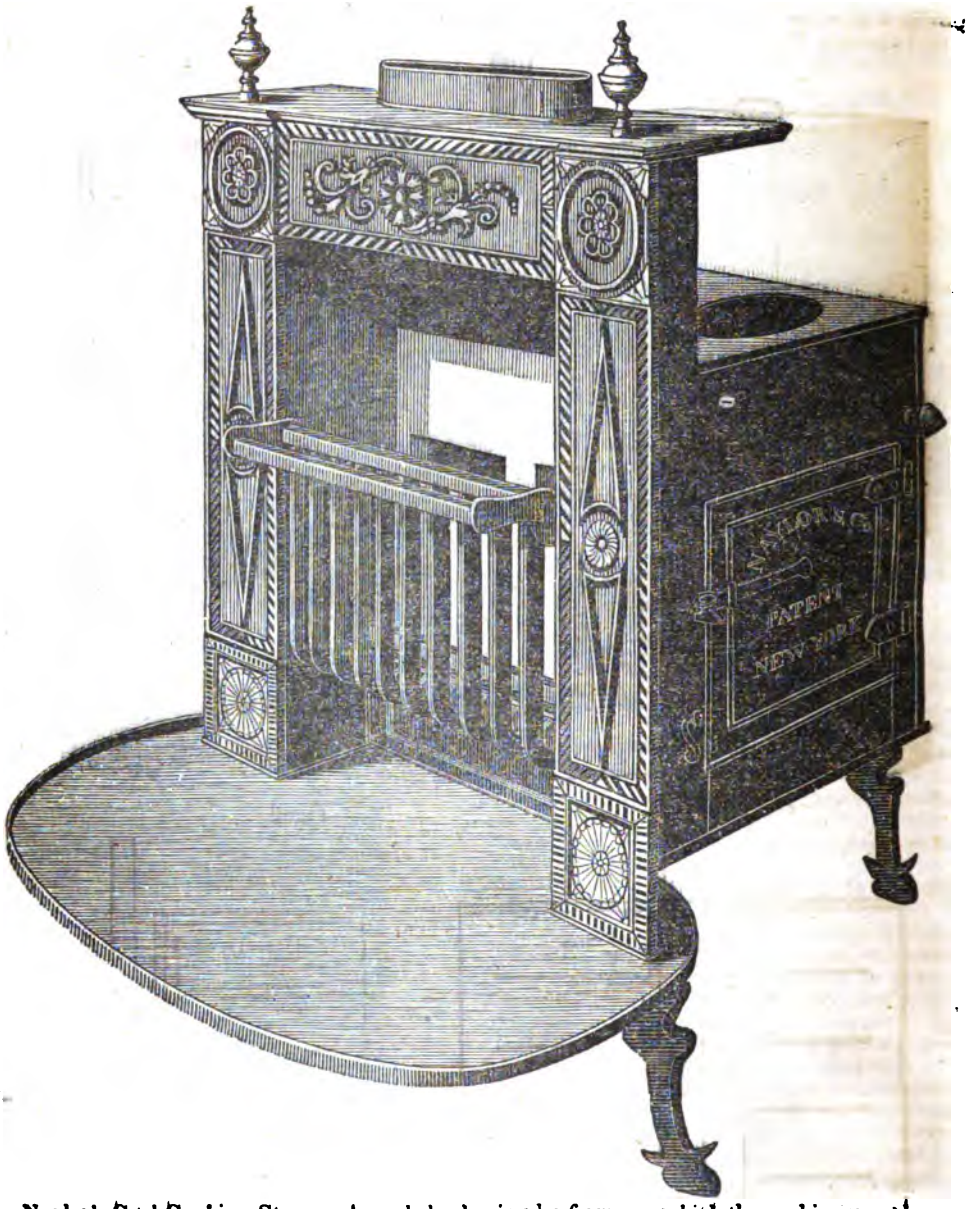


Fig. 3.



ly well, though several stories high. In this oven the lower shelf is made double, containing confined air. This prevents what is on the shelf from being burned at the bottom. It is made thicker the front side next to the door, so that its under side may be an inclined plane. The furnace is round, and is located under this shelf, entirely in the oven, except the part which catches the ashes. The partition in this is the same as in the other. It will be seen that the heated air must be carried to the back side of the oven, where it will ascend as in the other, and the operation will be the same.

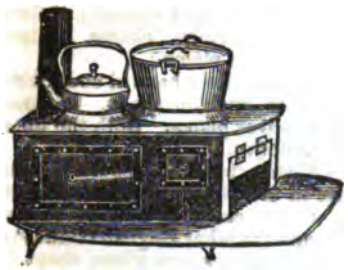
H. Nott & Co., 2d premium for Portable Bake Ovens—a diploma.

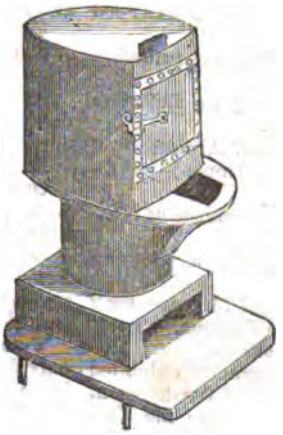


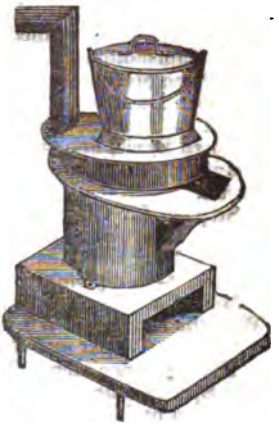
Naylor's Coal Cooking Stove, acknowledged the best article of the kind ever brought into the market. The demand having been extensive, and the improvements great this year, will be a further recommendation to it. The improvements are a greater increase and equalization of heat to the boilers, a greater facility in cooking, economy in fuel, and a total preventive of the dust arising from coal.

A Model of a Cooking Stove, invented by Dr. Payne, 13 Beekman st., New-York; quite novel in its operation. The grate, or furnace, in which the wood, or coal, is burned, turns horizontally under a shallow heat chamber, of a circular form, on which the cooking vessels are placed, which enables the cook to put the most intense heat under the vessel, or vessels, that most require it, the burning surface of the fuel coming in immediate contact with the bottom of the vessels, whilst the heated air from the furnace, or grate, by an ingenious and compact arrangement, passes from the furnace under all the vessels, in a circle, before it escapes into the stove pipe, which is placed in the centre of the circle. The range, or grate, is so constructed as to afford ample and convenient room for roasting and broiling, without occupying a space more than 3 feet square. The stove may stand on legs, or be suspended.

Graham's Stove,—as represented by the subjoined cuts. We have before us several testimonials from persons who have had it in use some time, who all concur in stating that it fully answers their expectations. It is cheap—simple in its construction—neat in its appearance—and economical as to the quantity of fuel consumed.







Cabinet Ware.

J. C. Jenckes, a Carriage Chair for an Invalid—a diploma. A very ingenious contrivance, by which sick persons are able to move themselves from room to room, and also alter their position of sitting.

A splendid Perspective Pier Table, inlaid with upwards of one hundred and fifty pieces of wood of different shades and colors, so arranged as to appear like solid blocks or boxes, in whatever position you may stand to view it; manufactured by Wm. Fulcher, No. 88 Elm street, New-York.

W. Woolley, for a Sofa Bedstead, made by E. S. Woolley, and Frieze Window Covering—a diploma.

J. A. Patterson, fine inlaid top for Centre Table—a silver medal.

J. H. Farrand, for Spring Window Blinds—a diploma. Mr. F. exhibited a figure of a Pagoda or Temple, made in the form of a hexagon—as a model intended to illustrate at one view, by revolving on its centre, blinds for windows, both on an improved principle, and of original invention, and classed under the following heads:

Inside spring blinds, adapted either for linen, transparencies, maps, &c.;

Sun shades for outside, made to suit different forms of windows, which effectually screen the rays of the sun, and ventilate the rooms in hot weather;

Dwarf Venetian blinds, with vertical movement, striped Venetian and falling hood;

The painted Venetian blind differs from the old plan, inasmuch as it has an extra lath revolving on two rollers, centred in the top lath, which hangs in a horizontal position, thereby preventing the line either to cut or slip from the pullies, which being vertical to the holes in the slats facilitate the turning of the blind, besides effectually screening the rays of light.

Fine Arts.

Original Busts of McDonald Clark, the poet, and a Dead Infant, both sculptured by James V. Stout—silver medal.

These busts are stood on pedestals of the Scagliola marble, and are manufactured by Clark & Dougherty, 40 Hamersley street. They are, in point of strength, durability, richness of tint, vein and polish, fac similes of their originals, and what greatly enhances their value is the barrenness of the primitive quarries, among which are the lapis lazula, roseæ broseeido, yellow antique, &c., and the cost is from one-sixth to one-third of their models.

J. W. Dodge, 1st premium for Miniature Painting—a diploma.

J. James, 1st premium for Stained and Burnt Glass—a diploma.

Smith & Crane, 1st premium for Wood Carving—a diploma.

Mrs. Springsteel, 1st premium for frosted embossed Flower Work—a silver medal.

Miss Harris, 1st premium for Shell Flower Work—a silver medal.

W. J. Hubard, 1st premium for Portrait Painting—a diploma.

Edward D. Marchant, 2d premium for Portrait Painting—a diploma.

J. W. Hill, 1st premium for water colored Landscape and Marine Painting—a diploma.

Miss E. Johnson, 2d premium for water colored Landscape Painting—a diploma.

T. Chambers, 2d premium for water colored Marine Painting—a diploma.

Noel Delregney, 1s premium for Oil Landscape Painting—a diploma.

Hyatt & Smith, 2d premium for Oil Landscape Painting—a diploma.

W. Eagleson, 1st premium for Sculpture in Marble—a diploma.

R. J. Brown, 2d premium for Sculpture in Marble—a diploma.

George Endicott, two Portraits of Daniel

Webster and Doctor De Witt, in Lithograph, a fine specimen of that art in point of execution and likeness—a diploma.

W. Thompson, 1st premium for Engraving—a silver medal.

George Bird, 1st premium on Imitation Wood and Marble—a silver medal.

E. Ramsbottom, 2d premium on Imitation Wood and Marble—a diploma.

Joseph De Groot, 2d premium on Imitation Wood and Marble—a diploma.

Town Davis, fine specimen of Architectural Drawing, (the New Custom-House)—a diploma.

Stephen H. Gimber, fine specimen of Mezzotinto Engraving—a diploma.

Miss Margaret Ackerman, for a Painting on Velvet—a diploma.

Miss Cornelia Loomis, aged 13 years, for 2 Wreaths Embossed Work—a diploma.

Books and Stationary.

The best specimen of Typography exhibited was Sparks' Life and Writings of Washington, exhibited by Monson Bancroft, from the University Press, Cambridge, Mass.

Second best specimen of Typography, Byron's Works, published by George Dearborn, elegantly bound by H. & H. Griffin.

Best specimen of Blank Account Books, exhibited by Wm. Minns; the ruling very neat and perfect, and the binding, particularly of two volumes, highly finished and in good style.

Second best specimen of Blank Books, by D. Felt & Co., four very elegant specimens, as to ruling and binding.

Best specimen of Book Binding; Books of Common Prayer, bound by L. Turner.

Second best specimen of Book Binding, by H. & H. Griffin.

Best specimen of Sealing Wax; a great variety of beautiful samples, plain and variegated colors, by D. Felt & Co.

Best specimen of Manufactured Quills, by D. Felt & Co.

Best specimen of Maps, by Mitchell, Philadelphia.

Second best specimen of Maps, by D. H. Burr, N. Y.; a large and elegant Map of the State of New-York, with Plans of the cities and most important towns in the State.

The following articles were worthy of particular notice:

The National Portrait Gallery, published by M. Bancroft, press of Wm. Van Norden. Although it may be thought that this work falls more immediately under the department of the Fine Arts, this committee cannot omit to notice, with high approbation, the style of its execution, which is highly creditable to the publishers, and a favorable specimen of the progress of the arts in this country.

Book of Common Prayer, published by R. Bartlett & S. Raynor, press of Wm. Van Norden, a very neat and beautiful edition.

Mitchell's Reference and Distance Map of the United States, exhibited by C. Mould, agent, 155 Broadway, is a work which merits particular notice for its correct and handsome execution, and minuteness and variety of detail. It is accompanied by a volume (324 pages) of explanatory references, containing also a mass of important topographical and statistical information.

A fine specimen of Portable Writing Desk and Dressing Case, by Thomas Luff & Co.

Very superior Binders' and Paste Boards, by J. B. Cheeseman.

Music and Musical Instruments.

Rosewood Cabinet Piano Forte, No. 401, 6 octaves, with patent piccolo action, and cylinder fall, manufactured by Firth & Hall, No. 1 Franklin square. Silver medal.

One 8 keyed silver banded cocoawood flute, with patent roller springs, elastic cushion keys, and C & C silver plates;

Also, one 8 keyed silver banded cocoawood flute, with elastic cushion keys, common springs, C & C silver plates. Both the flutes manufactured as above.

Two Piano Fortes, by John Osborne. The only difference in the two musical instruments is, the one is what is called by makers French Grand Action, and the other English Grand Action. The above names are given them by way of classification or designation, as they are, in part, copied from those two nations, in their original mode of mechanism. Gold medal.

Bridgland & Jardine, 2d premium on Square Piano Forte—a silver medal.

Bridgland & Jardine, 2d premium on Cabinet Work, rose-wood Piano Forte Cases—diploma.

C. H. Eisenbrant, Baltimore, 1st premium on Flutes and Clarionets—a silver medal.

Rounberg & Schroeder, 2d premium on Flutes and Clarionets—a diploma.

C. G. Christman, for workmanship for an improved Flute—a diploma.

C. A. Eisenbrant, for a Brass Horn—a diploma.

G. Godene, for double Bass Viol—a diploma.

India Rubber Goods.

Captain L. Norcross' Water Dress—composed of a lead cap, which encloses the head, of 75 lbs. weight, and one foot in diameter, with a small glass in front, for the object of vision. The lower part has an opening, the edges of which rest on the shoulders and front and back of the chest equally.

The dress is made entire of India rubber cloth, with arms, gloves, legs, and feet, and made to fit loose. The end that joins to the lower part of the cap or helmet is made like the mouth of a bag. The operator draws it on whole, and then the upper part, or mouth, is tied close around the lower edge of the cap. Weights of lead are attached to the feet, of ten pounds each. From the top of the helmet there is a pipe as long as, or longer than, the water is deep, which the operator is going to work in, attached to an air pump. This is the air refreshing, or supply pipe; another pipe, from the helmet to the top of the water, is the discharge pipe. In the latter, there is a flat portion, about 6 inches long, made by stitching two flat pieces of sole leather together on the edges, situated about 6 inches from the helmet, and this constitutes the safety valve. On this valve, the pressure of the water acts so as to

prevent the escape of air from the dress, till the air, surrounding the body from the fingers to the toes, is more dense than the water, then a proper portion of the air escapes through the valve, and goes up to the surface, along the discharge tube.

Boston and Lynn India Rubber Company, 1st premium for India Rubber Goods—a silver medal. C. C. Nichols, 33 Fulton street, agent.

Also, from the India Rubber Factory, Roxbury, Mass. (warranted water and air tight)—

Ladies' India Rubber Camlet Cloaks; Gentlemen's Drab Pantaloons and Surtouts; Life Preservers; Silk Air Cushion; Ladies' Prunelle Shoes—a diploma. H. A. Winslow, 66 Maiden lane, agent.

Carriages, &c.

Isaac Mix & Sons, a very handsome Stanhope, with improvements in manner of putting on tires, worthy of particular notice; the rundle behind is well arranged for servant, or can be closed at pleasure—a silver medal.

Isaac Mix and Sons, one carriage, turn-over seat Stanhope, a well made and convenient article for a family. A diploma.

I. Cooke & Sons, one double seat Phæton. This carriage is so constructed that it can be used as a barouche, with a top to close all round, or as a double seat Phæton; by taking off the driver's seat and turning the front seat to face the horses, the top can be thrown down or removed at pleasure. A silver medal.

I. Cooke & Sons, a very handsome Buggy Waggon—a diploma.

Peter L. Donaldson, Newark, N. J., for Gig Axles—a diploma.

Gold, Silver, Plate, Jewelry, &c.

Mullen & Ackerman, for specimens of filagree jewelry—a diploma. W. J. Mullen, of the same firm, has been awarded a medal for two gold watch dials. Mr. M. deserves great credit for the perfection to which he has brought the American manufacture of this article. He was the first in this country to attempt their preparation, and now executes them in a style equal to any that can be imported.

James Thompson, 2d premium for Silver Pitchers—a silver medal.

Richards, 1st premium on Patent Spring Gold Spectacles—a diploma.

Robinson, Jones & Co., 1st premium for plain and fine gilt chased and fancy buttons—a silver medal. Attwater, Parker & Wilson, No. 8 Platt street, agents.

Ackerman's Lithometallic, or Jewel-pointed Pen, is a gold pen, with points made of a valuable jewel, and one of its peculiar advantages is that it cannot be corroded by ink, and may be used a long time without being at all injured or impaired by use.

After a little experience, a good writer will prefer it to the steel pen, as the ink flows more freely, and his hand-writing will be uniformly the same, and resemble more that of the quill pen. It is made portable for the pocket, and will be found, to persons travelling, a very useful and convenient article.

We defer (at the request of Mr. Williamson, the inventor,) giving a description of the newly invented graduating silver steel pen, which received the premium of a gold medal.

Marquand & Co., 1st premium for Silver Pitchers, Spoons, and Forks—a silver medal.

Jared L. Moore, for fine specimen of Gold and Silver Spectacles.

Leather, Boots, Shoes, &c.

Sherill & Reed, Salisbury Centre, Herkimer county, 1st premium for hemlock tanned Sole Leather—a diploma. Thomas Brooks & Sons, agents, No. 60 Vesey street.

Quackenboss, Wynkoop & Co., 2d premium for hemlock tanned Sole Leather—a diploma.

W. Leek, 1st premium for oak tanned Sole Leather—a diploma. Isaac Bullard, agent.

F. K. Boughton, Utica, 1st premium for Otter and Seal Skin Caps—a diploma. For sale at 168 Water street.

J. W. Brodie, 1st premium for dressed Otter Skins—a diploma.

J. D. Williams, 1st premium on dressed Muskrat Skins—a diploma.

T. Lane & Son, 1st premium for Ladies' Boot and Dress Slippers—a diploma.

Alexander Clark, 1st premium on Gentlemen's Calf Skin Boots—a diploma.

J. G. Vandenburg, 33 Wall street, fine specimen of water proof Gum Elastic Boots—a diploma.

S. C. Smith, fine specimen of lined India Rubber Shoes—a diploma.

Cloths, Cassimeres, &c.

Denny Manufacturing Company, Oxford, Mass., 1st premium for superfine black and blue Cloths—a gold medal. Steele, Wolcott & Co., 62 Pine street, agents.

Middlesex Company, Lowell, Mass., 2d premium for superfine black Cloth—a silver medal. Steele, Wolcott & Co. 62 Pine st., agents.

Wethered & Brothers, Baltimore, 2d premium for superfine blue Cloths—a diploma. Steele, Wolcott & Co., 62 Pine street, agents.

Daniel Buck, Lawville, Lewis county, N. Y., 1st premium for American Saxony Wool—a diploma. Steele, Wolcott & Co., 62 Pine st., agents.

Wethered & Brothers, Baltimore, 1st premium for black Cassimeres—a silver medal. Steele, Wolcott & Co., Pine street, agents.

Middlesex Company, Lowell, Mass., 2d premium for black Cassimeres—a diploma. Steele, Wolcott & Co., 62 Pine street, agents.

Dick & Sanford, Newtown, Conn., 1st premium for Satinets—a diploma. Charles N. Mills, 44 Pine street, agent.

John Wilde & Co., Bloomfield, N. J., 1st premium for White Flannels—a silver medal. J. Wilde, No. 12 Gold street, New-York.

A. Robinson, Fall River, Mass., 1st premium for Prints—a gold medal. Brown, Brothers & Co., 63 Pine street, agents.

Louisdale Company, R. I., 1st premium for Nankeens—a diploma. Lawrence & Trimble, 51 Pine street, agents.

Paul M. P. Durando, 1st premium for Boys' Clothing—a diploma.

Horne, Shepard & Fisher, a piece of Bleached Cotton Flannel—a diploma. L. Holbrook & Co., 53 Pine street, agents.

Premiums or diplomas were also awarded for the following:

Wm. T. Willard, for Covering for Vault Grate—a diploma.

John Woolley, 1st premium for Roofing—a diploma.

E. B. Sweet, 2d premium for Roofing—a diploma.

Beck & Lanmuier, 1st premium for Beaver Hats—a diploma.

A. & A. Bancker, 2d premium for Beaver Hats—a diploma.

J. M. Henderson, 1st premium for Silk Hats—a diploma.

Hyatt & Smith, 1st premium for Sign Painting—a diploma.

John M. Brown, 2d premium for Ornamental Sign Painting—a diploma.

J. F. Hanks, 1st premium for Ornamental Sign Painting—a diploma.

Judah A. Lee, 1st premium for Plain and Ornamental Penmanship—a diploma.

S. Andrews & Co., Perth Amboy, 1st premium for Combination Lock, invented by S. Andrews—a silver medal.

J. G. Pierson & Brothers, 1st premium for Wood Screws—a diploma.

T. & B. Rowland, Philadelphia, 1st premium for Mill Cross-Cut and Pit Saws and Shovels and Spades—a silver medal. Edward Field, No. 1 Platt street, agent.

Lewis McKee & Co., Plymouth, Conn., 1st premium for Chest and Cabinet Locks—a diploma. Atwell, Baker & Wilson, agents, No. 3 Platt st.

W. Hunt & Co., Douglass, Mass., 1st premium for Axes and Hatchets—a diploma. Agents, Hubbard and Casey, No. 48 Exchange Place.

Johnson & Co., 1st premium for Cosmetics, Fancy Soap and Perfumery—a diploma.

O. S. Williams, 1st premium for Travelling Trunk—a diploma.

R. R. Chamber, 2d premium for Travelling Trunk—a diploma.

R. H. Oldson, 1st premium for Hobby Horse—a diploma.

New England Crown Glass Company, first premium for Boston Crown Glass—a diploma. Charles Goff, 164 Maiden lane, agent.

B. Bosch, 1st premium for Secretary Book Case & Standing Mirror—a silver medal. Joseph Titcomb, 196 Broadway, agent.

Lowell Company, Lowell, Mass., 1st premium for Hearth Rugs—a silver medal. Stone, Swan & Mason, Pine street, agents.

Powers & Co., Lansingburgh, 1st premium for Oil Cloth—a diploma. T. L. Chester & Co., agents, Broadway.

Charles Attwood, Middletown, Conn., 1st premium for Metallic Pens—a diploma.

A. Denslow, Hartford, Conn., 1st premium for Card Wire, manufactured at the Rainbow Mills—a diploma. John Whittemore, 66 Frankfort street, agent.

William Field, for Vertical Trip Hammers—a diploma.

J. C. Stevens, for a model of a Fire Engine—a diploma.

Bollen, Pollard & Co., Hartford, Conn., for specimens of Box Wood and Ivory Rules—a diploma. Pettibone & Long, No. 4 Liberty street, agents.

Mr. Thompson, 1st premium for Paste Blacking—a diploma.

Wm. Sturdevant, 1st premium for purified Sperm Oil—a diploma.

W. Woolley, first and second premiums for two Surgical Bedsteads—a gold medal. For a full account of this valuable invention see p. 71, vol. iv., of this Magazine.

Dr. Leo Wolfe, third premium on surgical bedsteads—a diploma.

R. & E. Orrell, Providence, R. I., first premium on Weavers' Reeds—a silver medal.

Blake & Brothers, New-Haven, first premium on Escutcheon Latches—a diploma.

N. Hooper & Co., Boston, first premium on Mantel and Astral Lamps—a silver medal. John Nye & Co., 90 South street, agents.

C. Cornelius and Sons, Philadelphia, second premium on Mantel Lamps—a diploma. P. N. Haughwout & Son, 609 Broadway, agents.

M. Lefoulon, fine specimens of Stone Ware—a diploma.

L. Decasse, fine specimens of Fire Brick and Pipes, for conducting water, manufactured at the Salamander Works—a diploma.

Lowell Company, Lowell, Mass., fine specimen of Venetian Stair Carpeting—a diploma. Stone, Swan & Mason, Pine street, agents.

Norwalk Felt Co., Norwalk, for Felt Carpeting and Rugs—a diploma.

P. Luff & Co., fine specimen of Portable Writing Desk and Dressing Case—a diploma.

William Fulcher, splendid inlaid Centre Table, made of American wood—a silver medal.

R. J. Brown, an elegant Marble Centre Table—a silver medal.

Underhill & Ferris, a beautiful Carara Marble Fireplace—a silver medal.

R. Heinish, Patent Tailors' Shears—a silver medal. J. Andrews, 147 Fulton street, agent.

T. Thomas, for Painting on Glass—a diploma.

Isaac F. Bragg, fine specimen of Penmanship, sent in for exhibition only—a diploma.

A. Macklin, fine specimen of Embossing from Brass Cylinders—a silver medal.

D. Berrien & Co., for superior Smith Bellows, Fancy Brushes and Bellows—a diploma.

E. & J. Fairbanks, a Concentrated Platform Scale—a diploma.

J. M. D. & T. W. Keating, 3 small models of Steam Engine—a silver medal.

G. Hodges, Andover, Mass., for Flannel made in imitation of Welch—a diploma. Stone, Swan & Mason, agents, Pine street.

J. B. Cheeseman, fine specimen of Pasteboard—a diploma.

Thomas Godwin, fine specimen of Gilding on Glass—a diploma.

Esther R. Cobb, Wrentham, Mass., a very fine specimen of a Lady's Hat, made of rye straw—a silver medal.

Henry Keep, 2 fine specimens of Fancy Tuscan Bonnets—a diploma.

A & S. White, a very handsome specimen of Tuscan Hats, made of foreign materials—a diploma.

F. A. Kipp, & C. Cordes, fine specimen of Starch—a diploma.

Mrs. S. Little, a splendid Feather Bonnet, made of Poll Parrot Feathers—a silver medal.

Sebastian Jaclard, for Wigs, Toupees, &c. —a diploma.

Samuel Judd, for specimen of Spermaceti Candles—a diploma.

J. A. Riell, for specimen of Macaboy Snuff —a diploma.

Miss Mason, for specimen of Bead Bag—a diploma.

Miss Clark, several elegant specimens of Worsted Flower, and other ornamental worsted work, together with some handsome specimens of Drawing—a diploma.

Miss L. A. Browere, fine specimen of Wax Fruit and Flowers, and a pair of Transparent Blinds—a diploma.

Miss B. Van Tuyl, a specimen of Gilding on Velvet, and a Landscape Painting in oil —a diploma.

Miss Lucretia Fordham, Brooklyn, aged 14 years, a pupil of the Mechanics' School, a specimen of Worsted Embroidery—a diploma.

W. Williams, a pair of Worsted Lamp Mats —a diploma.

Miss Ann Eliza Constantine, aged 12 years, a pupil of the Mechanics' School, a piece of Shell Embossed Work—a silver medal.

Japanned Ware, exhibited by J. Smith & Son, Nos. 217 Water and 244 Grand streets, to show that Japanning can be and is brought to as great perfection in this country as in the old; and secondly, that the said persons do manufacture japanned goods to compete with the imported; and, thirdly, that old goods which have been in use for many years, so that the japan is almost, or altogether, worn off, can be, by them, (and they are the first that have done it in this city,) be made equal to new. 2d premium—a diploma.

T. Ternan & Co., 1st premium on Japan Ware—a diploma.

F. Reynolds, specimens of Plain Needle Work —a diploma.

Miss Mallison, fine specimen of Wax Flowers—silver medal.

Miss Sarah Maria Street, New-Haven, aged 13 years, one Chair Seat, an elegant specimen of embroidered Canvas—a diploma.

Mrs. Cooke, of New-Jersey, two Shell Boxes, one pair Shell Vases, and one Shell Watch Stand—a diploma.

Miss Thompson, two vases, fine specimen of Wax Flowers—a diploma.

Miss Margaret Fanshaw, a Bed Quilt, containing 16,800 pieces—a diploma.

Mrs. W. R. Addington, a Shell Wreath and Box—a diploma.

Mrs. Baldwin, a Shell Basket—a diploma.

Lesinda Lydsback, a fine specimen of Blue Silk Vest—a diploma.

Robert Ward, fine specimen of Carving, Butcher, and Cook's Knives—a diploma. J. Andrews, 147 Fulton street, agent.

J. Russell & Co., Greenfield, Mass., fine specimen of Socket Chisels—a diploma. Edward Field, No. 1 Platt street, agent.

Edwin Ellis, Attleborough, Mass., Brass Butt Hinges—a diploma. Atwater, Baker & Wilson, No. 8 Platt street.

D. E. Delavan, fine specimens of brass Stair Rods, brass and copper Coal Hods, brass Tea Kettle and Stand—a silver medal.

Wm. Morgan, an ingenious Pocket Pistol—a diploma.

F. W. Widman, Philadelphia, case of splendid Swords—a silver medal.

Timothy Dwight & Son, New-Haven, specimen of Screw Augers—a diploma. Ibbotsen Brothers, 242 Pearl street, agents.

Ewin & Heartte, Baltimore, for excellent specimen of Leveling Instruments, and improved Leveling Instrument and a Theodolite Compass—a silver medal.

Wm. J. Young, Philadelphia, for excellent specimen of Railroad Goinometer, an improved Compass, and a Level Goinometer—a silver medal.

John Roach, a fine Barometer, Thermometer, and Hydrometer, in one vertical column case—a silver medal.

Henry Cooke, for a Drill Breast-plate, with a Swivel—a diploma.

U. S. West, for a Bottle Faucet, for tapping a bottle without drawing the cork—a diploma.

N. J. Williams, for Weavers' Shuttles and Reeds—a diploma.

Jeremiah Dodge & Son, fine specimen of Wood Carving, two Stancheons for a Fire Engine—a silver medal.

Wm. E. Stoutenburgh, for a four-light Suspended Lamp and twelve-light Chandelier—a silver medal.

E. S. Scripsure, a centripetal Power Press—a diploma.

O. Parker, for Hydraulic Cement for making durable Cisterns and large Stone Vessels—a gold medal.

Eaton & Gilbert, Troy, a very fine Omnibus —a diploma.

E. & S. S. Rockwell, Patent Vault Light—a silver medal. [See page 91.]

Fredericks & Smith, for a splendid French Chair—a silver medal.

Robert Usher, two fine specimens of Spiced Beef—a diploma.

Delano & Sons, good specimen of Iron Chests—a diploma.

W. B. Green, good specimen of Iron Chests —a diploma.

F. Fossard, for a piece of La Fayette Blue Cloth, a dye substituted for Indigo—a diploma.

Aaron Gilbert, New-Lebanon, one box of Shakers' Herbs—a diploma. Rushton & Aspinwall, 86 William street, agents.

Mrs. Jessie E. Paul, for fine specimen of Cotton Fruit—a diploma.

Miss A. Lewis, for a piece of Embroidery on Canvas—a diploma.

Samuel Allen, one bale of Hemp, raised at Copenhagen, N. Y.—a diploma. Peter Remsen & Co., No. 109 Pearl street, agents.

S. N. Brewer & Brothers, Boston, for speci-

men of Lozenges. D. & E. L. Perkins, No. 9 Courtland st., agents.

Robert G. Lamphier, Washington city, D.C., for a fine specimen of Seal Engraving—a diploma.

Mr. Charles G. Christman, improved twelve keyed Flute, manufactured at 398 Pearl street, New-York.

The Rev. William Fisher, Meredith, Delaware county, N. Y., specimen of refined Maple Sugar—a diploma.

Refined Sugar, exhibited by H. & J. Stuart—a diploma. Without exception the most excellent and finest sugar that ever came under our notice. We recommend to all house-keepers to examine it for themselves, and we are satisfied it needs no other recommendation. Ladies particularly, will find it a valuable appendage to the tea table, as well as for other domestic purposes.

Madam Doyley, fine workmanship one pair Corsets—a diploma.

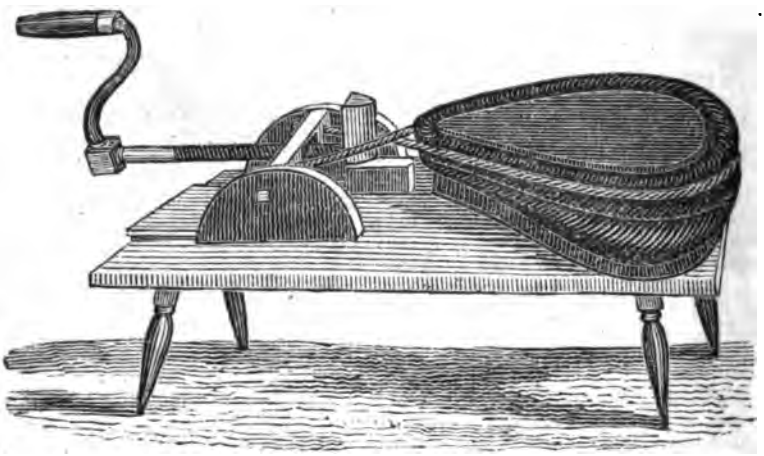
Specimen of a Straw Hat, from the manufactory of J. D. Cobb, Wrentham, Mass. The fabric is rye straw, of Wrentham growth, braided by Miss Adeline Pond, and sewed by Mrs. Esther R. Cobb. Its fineness cannot be surpassed. It is a beautiful specimen of American enterprize and industry.

Fancy Glass Working, Blowing and Spinning, by W. J. Hanington, of the American Museum and 450 Broadway.

Birds and animals were made to resemble life; also pans, globe vases, decanters, segar tubes, pipes, glass plumes, and various other articles, formed at the blow-pipe of the glass while in a state of fusion, in the presence of the company. The process of glass blowing in all its varieties, at intervals blown finer than leaf gold, when it bursts with the report of a pistol, forming a shower of glass, frosting, tinted with all the various prismatic colors; glass spinning, on a wheel of multiplying power; by this process red hot glass was spun at the rate of 1000 yards a minute; specimens of ribbons were shown, manufactured from this material; glass balloons, in jars, made repeated ascensions; pulse and spirit glasses, together with philosopher's or water hammer.

H. J. S. Hall, best specimen of Fire-Works—a diploma.

Nathan Post's Patent Hame Collar Blocks, manufactured and sold by Francis S. Lane, No. 279 Bleecker street, New-York.



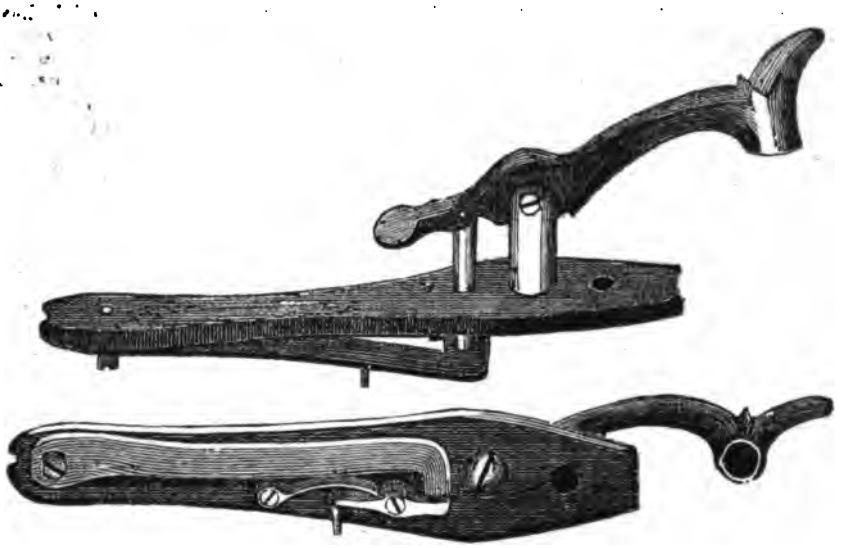
These patent blocks and rights may be had at the place above mentioned, or at the store of Henry Storms, No. 179 Water street, corner of Burling slip, where one may be seen constantly in use. The proprietor of this invention takes pride in offering it to the trade as one of the most important discoveries in crimping and perfecting the hame collar, both with regard to saving labor and producing accuracy of form, that has ever been the subject of a patent.

"I hereby certify that I have used one of the above mentioned blocks for shaping hame collars, and find it to be a great labor saving machine, which overcomes the great difficulty heretofore experienced in making collars, both for the ease of the horse and a sufficient bed for the hame, and I do not hesitate to say that it is particularly worthy the notice of manufacturers. HENRY STORMS, Saddler."

[The above is doubtless important, particularly when we consider the pain and injury inflicted on horses from the use of ill-shaped hames.]

We have seen a Gun Lock,* invented by a sporting gentleman of Virginia, with which we are much pleased, and, if we are not mistaken, it will supersede the percussion lock now in use. It is styled the "Lateral Percussion Lock," and differs from the lock now in use in having a hammer that plays lateral to and parallel with the barrel on the tube, which is introduced precisely where the touch-hole of a flint gun is usually placed. The interior construction is remarkably plain, not half so complex as the common lock. By the lateral hammer, the upright cock of the flint and the hammer of the percussion gun is entirely done away with:

* These were intended to be exhibited at the Fair, but arrived in New-York too late.



consequently, the top or upper surface of the barrel presents a smooth and perfectly even appearance. Sight in the flying shot is much more accurately taken by this means, in consequence of the absence of the elevated cock. The facility with which the flint gun can be altered to the percussion is another very great advantage arising from this improvement. The gentleman has promised us a more particular description of the lock, which will be hereafter inserted. [See engravings above.]

Ne-plus-ultra, or Mississippi Life Boat, invented by Daniel M. Toll, M. D. of Schenectady. The object and use of the boat being determined upon, ought to govern its dimensions; the hull of one boat is to be constructed of the requisite dimensions, that is to say, of proper width, length, and depth, whose sides, between the curve where the bow commences and the curve where the stern commences, are to be a perfect longitudinal parallelism; her sides, in a vertical direction, are to observe a curvilineal line—they are to be, in other words, a perfect arc of a circle. A cross section of the hull is to be a circular zone, the longest cord of which is to be the transverse line of her deck, and the shortest cord to be the transverse line of her bottom; her bow and stern are to be shaped and modeled in such a manner as will give her, when in motion, the greatest possible relief from positive and negative pressure. Her deck and bottom are to be pierced or perforated with a series of openings, in a lineal direction from bow to stern, of a magnitude in her deck to receive the largest circumference of a hollow sphere or globe, and in her bottom of such diminished dimensions as to receive only a segment of the same globe or hollow sphere. Bulkheads are to be constructed perfectly water tight within her hull, that is, between her deck and bottom, and to join close all around upon the margin of the perforation which is in the bottom of the boat or hull, and carried up and joined close on and all around the margin of the perforation in the deck: this bulkhead is to be shaped as to assume a globular form, and to encompass and give facility for a globe to revolve, which is to be suspended in its chamber: the residue of the perforations and chambers, for the reception of the globes, are to be finished in the same manner: the residue of the whole remaining part of the boat or hull is to be divided off into compartments by perfect water-tight bulkheads: next, a requisite number of hollow globes or spheres are to be made, and of a proper magnitude, mounted with iron axletrees through their axis, and the ends sufficiently projecting to answer for gudgeons; these globes, so mounted with their axletrees, and perfectly water tight, are to be suspended in the above mentioned chambers, fastened and secured in sockets or boxes in a workman-like manner, and with a segment of the globes projecting through the orifice in the bottom of the boat or hull, so that the globes may revolve with facility, to enable them to carry the boat over the shoal or bar with facility; this one boat or hull, now considered finished, another, of the same dimensions, and built every way in the same manner, is to placed by her side and parallel with her, and at a proper distance: these two twin boats are to be connected with suitable cross-beams and timbers, supported a sufficient height above deck with stancheons, and the whole well secured with proper braces and fastenings in a workman-like manner, the whole of which will constitute the float or bottom of my boat.

The above described boat is intended should be built either of iron or of wood, or of iron and wood combined, or of any other material; she is intended to be used for passage or freight, or any other use that any other boat is used for, and she is intended to be moved by any tractile or motive power. And further—on the above

float or bottom of my boat, a superstructure is to be erected, as fancy or necessity may direct or dictate. And again, it is the intention of the inventor, that the stern of each of the twin boats should be carried back the requisite length, in imitation (or nearly so) of an eel's tail, so as to give her run a clean, smooth exit, with the least possible distress from negative pressure when in motion; her bows are to be carried forward so as to assume the most elegant tapering form, thereby enabling her to separate the resisting particles in the most easy manner, to give relief to positive pressure.

The invention and improvements herein contemplated consist in giving additional security to my water wheel, by being placed between the twin boats, and by obtaining buoyancy and speed, and likewise by giving facility to the crossing of shoals or bars in shallow water by the rolling and revolving of the globes on their axles, and likewise by securing and retaining the buoyancy of the whole of the uninjured part of my boat as a compensation for the loss of that part which might be pierced or penetrated by the impetus of a snag or any other substance.

The objections that may be raised or suggested to her speed, in consequence of the projections of her globes through her bottom, will yield on the least reflection, for as soon as the resistance amounts to the sum of the friction on the axletrees, the globes will revolve and thereby relieve the resistance.

And again—the apprehension that may be had on the score of resistance from the small and slender sheets of water that will be standing around the globes in the chambers, will as readily vanish by reflecting that the cohesion of water is merely nominal.

Observations.—This boat may be built and used without either globes or compartments, where there is plenty of water and no danger of having her hulls pierced or perforated. Again, she may be used with or without her globes, with or without her compartments, or any other way, as the case may require.

Account of a Visit to Mexico.

Xalapa, U. S. Mexico, June 28, 1834.

To the Editor of the Mechanics' Magazine:

Dear Sir,—You will recollect that we sailed from New-York on the 21st ult. for Vera Cruz. Nothing worthy of note occurred until the 2d of June, at which time we came into contact with a *water spout*, lat. 29° 8′ north, long. 74° west from Greenwich. The cabin passengers were below at breakfast. The second mate, who had charge on deck, gave us a sudden alarm, by hastily reporting at the cabin gangway, "A water-spout off the weather-bow, sir!" Those of us who were aware of the dangerous consequences of coming in contact with one of these aerial missiles of destruction, immediately arose from our seats and ascended on deck. Here we beheld a meteor, grand and beautiful indeed. It approached us in all its elemental grandeur, towering to the clouds, and looking down to scorn the power of man. Its distance from us, at this period, might have been about two miles, and, as the breeze was very light, we were completely exposed to its effects in case it should make towards us. It was watched attentively for a few minutes, when it was observed to settle very much, and, it was supposed, had broken. It was also judged that its course was such that it would not strike us in case of its renewal. We were shortly convinced of our error. The passengers were scarcely re-seated at the breakfast table, when the second officer again reported, "It is making for us, sir!" The captain immediately went upon deck, and in an instant after cried out at the top of his voice, "All hands on deck; passengers on deck to lend a hand!" I have said the wind was light; moreover, it was a leading wind, and previous to our seeing the water-spout, we had every sail set that could be made to draw. On the first call to deck, the studdin'-sails were taken in, so that, at the last call by the captain, we had all other sails set, from royals downwards. On our reaching the deck the dreadful missile was not more than 100 fathoms from us. It had renewed its former height and magnitude, and came booming on at our devoted craft with a loud rushing noise, in all its terrific grandeur, threatening us with instantaneous destruction. To clue up sails was impossible, therefore every thing was "let fly," sheets, halyards, &c. All was now done that could be done. The state of suspense and intense anxiety for a few moments is more easily conceived than described. Some were at prayer, audibly or otherwise, and all were motionless. It came upon us midship, the first contact heeling the vessel to the leeward. When about half over, the vessel righted, and when it left us it gave us a heel to the windward. Not a sail was rent nor a spar carried away. Not a man was injured, neither did a drop of water fall on deck.

Previous to the water-spout reaching us it was thin—in fact, was easily seen through; but after it had passed, it seemed to increase in density and opacity; hence, agreeably to the best received theory, it is probable that the water-spout, at the time it struck the vessel, had not been in its renewed state (before alluded to) a sufficient time to have become mechanically charged with water, otherwise it would have burst upon us and inundated, if it had not destroyed us. The diameter of the spout at the bottom was about forty feet, and it was very attentively and closely observed as it approached. That it had all the characteristics of a whirlwind is certain, and the spray which was thrown off *tangentially* from its exterior showed most conclusively that it gyrated in a *spiral* form, its motion being upward, thus raising water upon principles somewhat resembling those of Archimedes' screw. Its revolution was against the sun—i. e., from right to left. I do not mean to have it understood that I am by any means *convinced* that the water in these meteors is always *raised*; it may, and probably does, sometimes descend from the clouds. When the water is raised mechanically from the ocean, it will be salt;

when it descends from the clouds it will be fresh; but we have so few authentic accounts of their *bursting on the ocean*, that I am inclined to the belief that they are neither more nor less than whirlwinds raising sea-water the same as they raise objects upon the land.

This spout was first seen at half past 7 A. M., and at this time the barometer was one-eighth of an inch lower than it was an hour before. Just previous to our contact, the barometer had fallen an additional eighth of an inch, and immediately after the spout had passed us it was the same. An hour after the last observation, the barometer had ascended to the same height which it had previous to the appearance of the spout.

The aspect of the heavens was cloudy, somewhat broken, but having little motion. Some of the clouds were more elevated than others, the cumulo-stratus and nimbus of Howard. No rain had fallen during the morning.

The following statement will exhibit at one view the states of the barometer and thermometer during the interval of time included in the above account, viz.:

	Barometer. Inches.	Therm.
At half past 6 A. M. - -	29.75	71°
When the water-spout was first seen, at half past 7 A. M., 25 to 30 minutes before striking us, - - - - -	29.625	70.5°
Just previous to the spout's striking us - - - - -	29.5	—
Immediately after do. do.	29.5	70°
One hour after the last observation, - - - - -	29.75	71°

In the third observation the thermometer was not noted for want of time.

The above is only a slight additional proof of the immense value which the barometer has for purposes of practical navigation. It is true that experience and prudence in commanders of vessels often preserve them in dangerous circumstances by taking the necessary precautions, but this is no reason why every additional security should not be given to the lives and property of our seamen and merchants. Every vessel which traverses the ocean should have an accurate barometer, which should be carefully and punctually attended to, and registered in the log book.

Our passage through, or rather across, the gulf or bay of Mexico, was tedious and unpleasant, a remark that will apply to the whole passage from New-York to Vera Cruz; the weather being very warm, and our accommodations on board very much limited. I have heard the splendor and beauty of the tropical skies extolled so much and so often, that I took it for granted I was to have a feast of vision which would in some degree compensate for the inconveniences of an imprisonment of many days upon the domains of Neptune. But, alas, disappointment came. There is infinitely more splendor and *elasticity* (if I may be allowed the expression) in our northern skies, particularly in a clear November night. It is true, we see some stars in tropical climes which are not visible to us at home; but there is a lassitude, a certain je ne sais quoi, that takes away all the zest for me.

On the 18th of June, we entered the harbor of Vera Cruz, very much to our gratification. I believe few persons could be found who would not prefer terra firma to the deceitful and treacherous gulf of Mexico. After having undergone an inspection by the visiting surgeon, and he having ascertained that there were no cases of cholera among us, the Vera Cruzans being very apprehensive of another visit from this Protean disease, we were permitted to land. Some of us had been unwell for a few days previous, owing to our having been becalmed and exposed to excessive heat for some days in the gulf. We were moreover informed that there were cases of vomito in the city, and therefore determined to remain on board a day or two, until we should become in a slight degree, at least, acclimated.

At sunrise the next morning, a scene, novel and very interesting to an American, presented itself to our view. The atmosphere was unusually clear and transparent, and a gentle sea breeze gave it a wholesome and grateful feeling. Directly in front of us lay the antique and ruinous looking city of Vera Cruz, with its gorgeous domes, and structures of various appearances, and architecture, mostly partaking of the Moorish style. In our rear lay the castle of San Juan de Ullua; on our left the mountain of San Martin, reaching to the clouds, with other mountains; and islands and bays of greater or less extent. In some of these bays, at a distance of from one to three miles, many fishing boats were to be seen, the crews of which seemed to be busily employed in their avocation. In a south-westerly direction the Orizaba, 17,400 feet in height, rose in all its majesty, its snow-capped summit poising its everlasting congelation far above the access of man. The rays of the rising sun were reflected from this peak in the softest roseate hues conceivable.

At the expiration of two days on board, we landed at the Mole, and, having passed the custom-house without difficulty, took up our abode at a very neat and comfortable house, kept by Mr. Wm. Fulton, an American, whose politeness and attention are well calculated to insure custom, and give general satisfaction.

Vera Cruz is a regularly laid out city, its streets running at right angles to each other, and most of them are of a spacious width; some of the cross streets are, however, narrow and filthy; in fact, much could not be said in praise of the cleanliness of any part of the city which we saw. The number of dead, and, of course, putrifying animals, and other filth, which lie in different parts of the city, would vitiate and render the atmosphere unhealthy in a much higher latitude. The streets are well paved and have wide side walks, which are formed of a cement made with lime, sand, and shells, which acquires a peculiar hardness, and is very durable. I do not know that any particular proportion of these substances is required, and am inclined to believe the judgment of the ma-

ker is the guide. The houses of this city have all of them flat roofs, and are covered with cement; particular pains are taken to keep them perfectly clean, in order to preserve the purity of the rain water, which runs from them into large cisterns.

The public buildings of Vera Cruz consist of a palace, in which are the Government House, prison, &c., a custom-house, several churches, one or two convents, a theatre, hospitals, barracks, and some few others of minor importance. The public square, or plaza, is sufficiently spacious, but far from being elegant or attractive in any particular. It has on the north side the Palace, an ordinary looking building; on the east, the Cathedral, an old building of mixed architecture, principally Moorish; on the south and west, ranges of buildings having dwellings above and shops under the piazzas or "portales," below. The dwellings are generally commodious, having large, high, and airy apartments. Some of them are elegant, having towers or turrets on their roofs, admirably adapted for enjoying the sea breeze, a luxury inappreciable in latitude 19° 11′ north.

The increasing prevalence of that dreaded disease and scourge of this place, the *vomito*,* (a disease differing somewhat from the yellow fever of the United States and Havana,) and the oppressive heat and danger of exposing ourselves to the sun, compelled us to limit our excursions and examinations more than we desired. During the time we remained in the city, the average height of the barometer was 29.96 inches, and that of the thermometer, in the shade, 87°. The thermometer is often at this elevation in midsummer in New-York, but the heat of the sun is not near so oppressive as at Vera Cruz. In the cool of the evening, however, we sometimes ventured upon a ramble. The great place of resort for the Vera Cruzans, (the "Battery" of Vera Cruz,) is the Mole, which is now in a very dilapidated and decaying condition. It is said that its repair has been in contemplation for a long time. One thing is certain—if not soon repaired, it will be totally destroyed. But the climate of Mexico in these parts is admirably adapted to the production of procrastination among its inhabitants: "Manana," (to-morrow,) is the word with them. The Mole, as it is, is invaluable to the citizens of Vera Cruz, it being a place to which they resort for enjoying the sea breeze, social chit-chat, and the burning of tobacco, which both sexes are in the habit of doing in their mouths.

The public walk, "Alameda," lies in a southeasterly direction from the city, commencing at the eastern gate and extending about a third of a mile in an easterly direction. This, at some former period, must have been a beautiful, spacious, and shady promenade. Some few of the trees which were planted in rows on each side, are still standing. The way betwen these rows is well paved, and stone seats of a neat construction and appearance are placed along, at intervals, on the sides, for the accommodation of the promenaders.

The defence of Vera Cruz, in a military point of view, is very strong. The principal fortification is the castle of San Juan de Ulua. This is situated on an island to the northward of the town, distant about half a mile. It appears to be the well constructed work of skilful and competent engineers. It has a fine armament of cannon, mortars, &c., immense tanks for holding water, and can garrison 3000 men. It is a quadrangular fort, with four bastion fronts, one of which, the south-western, is bounded by the water of the harbor, having a depth of five fathoms close to the wall. On this front, large ring bolts are inserted and secured in the wall for the purpose of mooring shipping, to protect it from the violence of the *northers*, violent hurricanes peculiar to the gulf of Mexico. The other three fronts are bounded partly by the water of the harbor, and partly by a deep and wide ditch or moat covered by a glacis. This work is said to have cost about *thirty-five millions of dollars!* Report says that the King of Spain, when informed of its cost, went to his palace window, *in Spain*, to look at it, observing, that a fort which cost so much ought to be visible from all quarters of the globe. A similar work in the United States would cost about $600,000.

The population of Vera Cruz does not probably exceed five thousand souls at the present time. The former population is said to have been from 13 to 15,000, when it had a flourishing commerce. The causes which have contributed to this retrogression are various and evident: 1st, The unsettled and insecure state of its commerce during the first and succeeding revolutions and internal commotions, which have existed in a greater or less degree for the last fifteen years; 2d, The insalubrity of the climate is so great, that foreigners and others will not risk an exposure in it without comparative inducements, and no other inducement can generally exist than that of acquiring wealth, and since the accomplishment of this is almost entirely dependent upon a flourishing commerce, it follows that whatever is detrimental to this branch of human industry, is also detrimental to the prosperity of the city. Since the establishment of the present form of government, the duties are so onerous as to crush what ought to have been supported and fostered, and the immoral tendency of *smuggling* is thereby introduced. But it may be urged in reply, that the expenses of a newly formed government of a young nation, which has just thrown off the yoke of bondage, must be borne and obtained in such a way that the people may be least sensible of it. This may be true; but if the people are not sufficiently intelligent to know what most promotes their prosperity, they are hardly fit for a republican form of government. The ruinous effects of the retrogression of commerce upon this city cannot escape the casual glance of the stranger.

* The remedy most relied upon and universally used for this disease, is large doses of lime or lemon juice and sweet oil, repeated until an operation is produced.

The harbor of Vera Cruz is objectionable on many accounts, but it might be greatly improved. Vessels are now obliged to discharge by means of lighters or launches, and they are much exposed to the hurricanes called northers, which come in with great violence from the north and west. The construction of a breakwater from the westernmost point of the reef, about half a mile to the northward of the castle, could easily be effected, and would render the harbor comparatively secure and safe.

The soil in the vicinity is mostly sand and unproductive, consequently vegetables bear a very high price. The market, however, is tolerably good.

This place will always be memorable in the history of this country, it being the spot upon which that celebrated conqueror and most extraordinary man, Cortez, landed with his army in 1519.

On the 24th June we left Vera Cruz on our journey for the city of Mexico. Our road for the day lay partly over a level sand beach, and partly through bushes and hillocks of sand. It was excessively warm, the thermometer being at 102° in the shade, the sun nearly vertical, no breeze, and the reflection from a loose sand striking into our faces was very annoying. Add to this, we could proceed in a moderate walk only, and were obliged to stop at the end of every five or six rods to allow our horses to rest. For the last three miles of this day's journey, the vegetation on each side of us was luxuriant, and in all its tropical beauty. The trees were, many of them, of a good size, and all clothed in verdure. Large and excellent limes were hanging from branches frequent on both sides of us, and many of the trees were nearly invisible, being covered with a lichen or moss, resembling the missletoe, the fibres of which hung from the tops of the trees reaching the ground. The color of the lichen was whitish yellow. Shrubs and flowers of variegated hues also adorned our path. But the almost insupportable heat was a tremendous drawback to our pleasures. We arrived at Santa Fe a little before dusk, having passed over, for this day's journey, a distance of about nine miles.

Here a new scene presented itself to our view. A large company of "arrieros" (muleteers) had already unpacked their mules, and were encamped for the night on each side of the road. On one side their cooking fires were arranged in a row under large shady trees. At each of these fires an Indian was busily engaged in preparing maize or Indian corn, for the purpose of making a kind of cake called "tortilla." These cakes are made by first crushing and then baking the corn, in the following manner: A flat stone (generally porphyry) about 15 inches wide, and 20 inches long, is placed in an inclined position by means of two legs at one end, the other end resting upon the ground. This stone is called "metate." A stone pin or roller, of a semi-cylindrical shape, about 18 inches long, serves in the hand to crush the corn upon the metate, the corn being frequently moistened with water. This roller is called the "mano," or pestle. When the corn is completely crushed, so as to form a kind of paste, it is made into flat cakes between the hands, and baked on grating over the fire. These are tortillas, very inferior to our hoe-cakes.

On the other side of the road, in the front line, were the pack-saddles of the mules standing next to each other, in a perfect order of arrangement, each saddle being as well known by the arrieros as the men in the ranks of a military company are known to the captain. The second line was formed of the tents, or rather roofs, under which the arrieros sleep. This shelter is merely a coarse piece of sacking. The next line was formed by the bales and packages of goods which they were to transport to Mexico. These were properly and carefully protected from the effects of rain by a covering of mats, which were secured by ropes on each side, fastened to wooden pins, driven into the ground, and extending the mats in such a manner as to form pent-roofs, similar to the fly of a tent. Behind these the mules, about 250 in number, feeding at several long troughs, formed the last line.

Some of the muleteers were attending to the mules; others had taken to their tents; and others were dancing, singing, gambling, drinking, and flirting with the girls. These arrieros have the universal character of being the most honest and industrious class of people of the Mexican Republic. An instance of dishonesty seldom occurs among them. Yet they are a wild looking jovial race, resembling nothing in our country. My next will be dated from Mexico. J. P.

Railroad in Virginia.

ORANGE C. H., Va. October, 1834.

To the Editor of the Railroad Journal:

DEAR SIR,—I have noticed in the Virginia Herald a project for a railroad from Fredericksburg, or the Great Bend of the Potomac, to the Virginia Springs, through the Blue Ridge, &c. I look upon this scheme as both practicable and grand, as far as it goes. But one has only to open his eyes upon your new Railroad Map, which should be in the hands of every friend to internal improvement, in order to be convinced that if this railroad is continued on from the Virginia Springs to the ever navigable waters on the Great Bend of the Ohio at Guyandot, it at once opens the most superb highway that can possibly be constructed in the United States, to the great West. It unites the great South-west with the Atlantic in a much shorter distance than the great Erie canal; and when completed, will enable the farmers of the west to carry their corn, which now sells for 12½ cents a bushel, to the city of New-York in less than 48 hours. Besides, the public will be accommodated in carrying from the great valley of the Mississippi, and thence through Fredericksburg and Washington, Baltimore and Philadelphia, to your city, in a comparatively short period; whereas, to my knowledge, hundreds, if not thousands, have during the past

season waited at Guyandot, day after day, for want of conveyance to the White Sulphur and the northern cities. All the travel from the South-west to Washington City, during the session of Congress, will of course fall into this track, the route being nearer and quicker than any other. The inhabitants of Kanawha are now ready to do much for the construction of this road, in order to give free transport to the millions of bushels of salt now manufactured annually at their works. A few days ago I saw a merchant from near the salt works on his way to Philadelphia and New-York to buy goods, which he said he should send home by way of Pittsburg or Wheeling, and that he must wait for rains, because the Ohio was quite too low at this time, and at the best it required four weeks at least. Were the railroad of which we have been speaking completed, it would require no more than 44 or 45 hours to transport the same goods from New-York. If I had time I might mention other advantages, but I only wish to call the attention of the public to this route, and I am sure that they will at once see those advantages, and save me the trouble of mentioning them. I am glad to learn that wood for railroads can now be made durable, as it will greatly lessen the expense of excavations and embankments. In the route above mentioned, there are but few streams to cross, and the gaps through the mountains render it comparatively a level grade.

I remain, dear sir, very respectfully, yours,

J. McAdam, Jr.

On Sugar Refining in France.—As it is universally known that sirops are injured and decomposed by being too long exposed to an intense heat, various means have been tried to avoid the loss thereby incurred.

The methods which have met with most approbation are, 1st, the system of evaporating by steam; 2d, the system of evaporating *in vacuo*. Both are decided improvements on the process of evaporating on the naked fire.

But through the agency of steam, the sirops can be granulated only when raised to the temperature of 237° to 240° Fahr.; and when heated to that pitch, a material portion of the sirop is still decomposed.

The granulating *in vacuo* is attended with inconveniences of another kind. That system requires a great supply of water, expensive and complicated machinery, very liable to get out of order; besides, the operation takes place in closed and air-tight vessels, and the refiner cannot keep his eye upon it to direct it properly.

Some refiners have tried the use of atmospheric air to facilitate evaporation, but they have been obliged to renounce a scheme which they could not realize.

The art of sugar refining was, then, very far from perfection in France, when an invention, ingenious in its application, great in its results, and remarkable by its success, which daily increases, produced a complete revolution in that branch of industry.

A refiner of Lisle, Mr. Brame Chevalier, struck with the idea of using simultaneously steam for raising the sirop to the proper degree of heat, and air, heated by the same steam, to maintain the sirop in a continual agitation, conceived the possibility of obtaining by this means a very rapid and extensive evaporation at a very low temperature, thereby preserving the sirop from decomposition, and procuring a great economy of fuel and labor, and also greater returns in sugar.

This very ingenious theory has been most successfully realized. Nothing can be more perfect nor better contrived than the apparatus by which these results have been obtained.

A generator supplies the steam required to work a pump, which drives the air into a cylinder; there the steam heats the air to a proper degree; the heated air is then driven under the false bottom of a boiling pan, heated itself by steam, and escapes by small apertures through the sirop, which it causes to boil immediately.

The surplus of steam and heated air is used for warming the stove and store rooms, so that every operation of sugar refining, even that of clarifying, may be made with one boiler and one machine without the slightest danger of fire.

The boiling takes place in an instant, and as soon as the hot-air cock is opened. Evaporation takes place at 134° Fahr.; granulation is effected in eight minutes between 178° and 196° Fahr.

Martinique sugars, of the fourth quality, worked in this machine, do not produce more than six per cent. treacle, and fourteen per cent. of pale brown sugar, called in France, *Vergeoise*.

But great and important as this system is for sugar refiners, it is still more beneficial to sugar manufacturers, who extract the sugar from the beet root or the cane. It is easily conceived, as the saccharine juices, which do not weigh more than *ten* degrees, must be exposed much longer to the fire than the sirops proceeding from the melted sugar, which weigh generally thirty degrees. Moreover, by blowing hot air through the juices, they are purified of any unpleasant taste they may have acquired.

Finally, the advantages which account for the decided preference obtained by the system of Mr. Brame Chevalier, consist in its procuring more and finer sugar from the same quantity of raw materials of the same sort, and, moreover, in manufacturing, with greater rapidity, a superior sort of sugar.

These are positive facts, which are daily proved and verified by the great number of visiters who call at Mr. Brame Chevalier's sugar refinery at Lisle.—[Lond. Journ.]

The *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. Minor and J. S. Challis, at No. 35 Wall street, New-York: In *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 31¼ cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum *in advance*.—John Knight, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

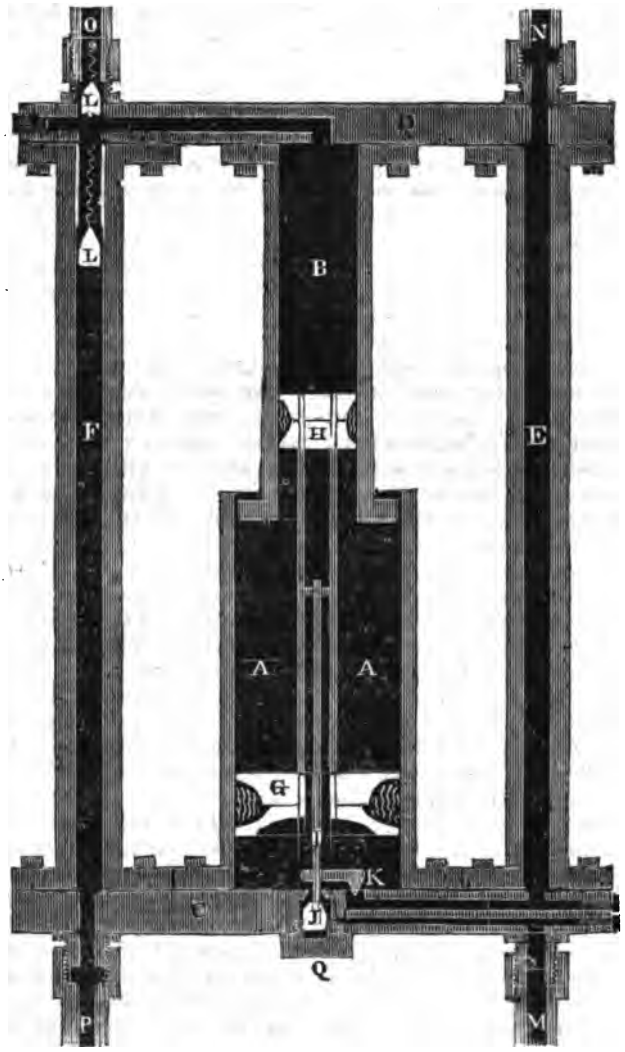
AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] NOVEMBER, 1834. [NUMBER 5.

"An atheist must be a madman. He believes that effects can exist without a cause; and if this is not lunacy, it would be difficult to say what is."—[ANONYMOUS.]

SECTIONAL VIEW OF R. PORTER'S INDEPENDENT PUMP.



Explanation.—A A, interior of the steam cylinder; B, interior of the pump cylinder; C, bed plate; D, cap plate; E, steam column; F, water column; G, steam piston; H, pump piston, and head of the piston rod; I, valve rod, where it passes through the cross spring; J, induction valve; K, eduction or exhaust valve; L L, pump valves; M, steam pipe; N, exhaust pipe; O, suction pipe; P, injection pipe; Q, short screw, which closes the valve chamber.

Improved Forcing Pump.

To the Editor of the Mechanics' Magazine:

Sir,—Permit me to inform the public, through the medium of the Mechanics' Magazine, that I have recently constructed, and have now in successful operation, an improved forcing pump, which will invariably keep the boiler of a steam engine supplied with water, to a given and uniform height, without ever permitting it to rise above; acting independently of the steam engine, being operated directly by steam from the boiler; and keeps the boiler as well supplied, while the engine is at rest, and even while blowing off steam, as at other times; and that without any attention from the engineer. I have made arrangements to have them manufactured to order, (warranted, of course,) by Mr. D. Copeland, Hartford, Conn.

Specification.—A hollow cylinder, four and a half inches in length, and two inches in diameter, having a flange at one end, is placed in a vertical position on the centre of a horizontal plate, which is six inches long, three inches wide, and half an inch thick, and to which the cylinder is secured by screws, passing through the flange into the plate. On the two ends of the plate are two vertical columns, each being eight inches in length, and three-fourths of an inch in diameter; and having a flange at each end, and an orifice three-eighths of an inch in diameter in the centre, are likewise secured to the plate by screws; and, in like manner, the heads of the columns are attached to another similar plate which rests on them. Another cylinder, four inches long, and one inch in diameter, is also attached by flange and screws to the centre of the under side of the cap plate, so that the bottom of this cylinder comes within, and, having a flange of the requisite size, closes the top of the cylinder first mentioned.

Within each cylinder is a piston with suitable packing, and the two pistons are connected by a hollow rod, five inches long, and half an inch in diameter; each piston occupying one inch of the end of the rod, thus leaving a space of three inches between the two. Within the piston rod is a valve rod, three and a half inches long, and one-eighth of an inch in diameter, having a flange head at the top: not so large, however, but that it will pass freely within the hollow of the piston rod. The other end passes downward, through an aperture in the centre of the bed plate, into a valve chamber, which consists of an orifice of half an inch diameter, extending upward from the bottom of the bed plate to within an eighth of an inch of its upper surface, and being closed at the bottom by a short screw, which also has a cavity in the end, the better to accommodate the valve. From one end, and near the bottom of the bed plate, an orifice an eighth of an inch in diameter is drilled horizontally to the valve chamber. Directly over, and parallel to this, is another orifice, which extends nearly to the valve chamber, where it meets with a vertical aperture from the upper side of the plate. These orifices are both closed at the outward end, but the first has a vertical communication with a small steam pipe, which is attached by an union joint to the bed plate, directly under the column, (which is called the steam column,) and the other has a communication upward, by another aperture, through the steam column, to another pipe, which is attached to the upper side of the cap plate.

Several small apertures, nearly in contact with that in the centre of the bed plate, complete the communication between the steam pipe and the steam cylinder; and these are closed occasionally by a circular or conical valve, three-eighths of an inch in diameter, which is attached to the bottom of the valve rod. Another conical valve is attached to an arm which projects from the valve rod an eighth of an inch above the upper surface of the plate; this valve occasionally closes the aperture which communicates with the steam columns; thus, the same motion of the valve rod, which closes one valve, opens the other. A thin elastic spring, two inches long, and half an inch wide, extends horizontally across the bottom of the steam piston, (which is a little concave,) being fastened to the piston by a screw at each end; and the valve rod passes through the centre of the spring. Thus, when steam is admitted, and drives the pistons upward, the spring receives the flange head of the valve rod, and, by raising it, instantly shuts off the steam; and, at the same time, raises the other valve, and thus allows the steam within the cylinder to escape by way of the steam column. From the upper side of the steam piston, two small rods, opposite and parallel to each other, extend upward through the bottom flange of the small cylinder, and through the cap plate; to the heads of these rods is attached a weight or spring, by which the pistons, when relieved from the action of the steam, are again forced down; and, by this motion, the horizontal spring comes in contact with the exhausting valve, shuts it down, thus opening the other, which again admits the steam to the cylinder.

Two other pipes, (water pipes,) are attached by union joints to the two plates, the

one above and the other below the other column, which is called the water column, with which they communicate by apertures through the two plates. The cap plate is perforated horizontally from the aperture to the centre, thence downward, thus opening a communication between the water column and the small cylinder. Within the water column is a puppet valve, and above it, near the upper surface of the cap plate, is another; both of which are held to their seats by spiral springs, opening downward, so as to admit the descent, but prevent the ascent, of water through the column and pipes. (The whole apparatus may be inverted, however, which would preclude the necessity of spiral springs.) By this arrangement, when the pistons are moved down, the small cylinder is filled with water from the upper water pipe, which communicates with a reservoir; and when the pistons are moved upward, the water in the cylinder is forced down through the water column to the boiler. Thus, by the force of steam, emitted from the boiler by one pipe, water is injected by another. Another advantage is derived from having the steam pipe descend to the proper water line in the boiler; that whenever the water, by the injection of the pump, rises above said line, the water is forced up in the steam pipe, and thus chokes the valves and retards the motion of the pump, while the water, thus escaping, is forced through the exhaust pipe, which also terminates in the reservoir.

I claim as original the construction and arrangement of the plates, cylindors, columns, and valves; and the application of steam direct to operate a pump, as connected with the regulating principle derived from the descent of the steam pipe to the water line as above described.

RUFUS PORTER.

A Few Words in Behalf of Mathematical Science.

[From the London Mechanics' Magazine.]

MR. EDITOR,—Will you permit a foreigner (a Swiss) to make a few remarks on Mr. Cheverton's article on the value and importance of mathematical science.

In the first place I must state, that had it not been for the false aspersions he has heaped upon some of the most illustrious of my countrymen, and more particularly on that excellent man Euler, I should have left him to enjoy all the honors and benefits that may arise to him from the said article.

In the first observation he makes upon Euler, he says, "the most valuable method of determining the longitude was at last accomplished through practical means, and by practical men. Euler aimed to produce an achromatic lens as well as Dollond, but it was the latter who succeeded; and their respective modes of proceeding mark both the character and comparative value of their efforts."

Well, in all this there is, perhaps, nothing very extraordinary (upon the supposition that Mr. Cheverton's statement is true.) Euler belonged to that useless race of men called mathematicians (according to the Chevertonian philosophy), and Mr. Dollond (Mr. John Dollond I presume he means) was certainly a first rate optician; not only so, but *also* (much to his discredit, no doubt,) a clever mathematician, and an able astronomer.

Mr. James Gregory, professer of mathematics in St. Andrew's, as it appears from his "Optica Promota," showed how a telescope with specula might be constructed; but this unfortunate mathematician being neither an artist, nor having any turn for practical mechanics, was himself incapable of realizing his own invention by an actual construction, although he had demonstrated that to form a perfect image of the object the speculum must have the form of a parabola. I might here, Mr. Editor, pause to inquire whether the arts or science at this period were in advance; but the question would carry its answer along with it. The unfortunate Gregory could not find a single artist in his own country that could grind a speculum for him. Poor Scotland! this appears to be a stain upon your escutcheon. But why, it may be asked, did not Gregory apply to some of the English artists? The answer is easily given. They were not, at this period, one jot farther advanced in the arts than their northern neighbors.

Soon after the period just alluded to, the immortal Newton found himself compelled to relinquish for a time his philosophical pursuits, and betake himself to the mechanical art of grinding specula. His first attempt was to construct a reflecting telescope according to the principles of his friend Gregory, that is, with a parabolic speculum. In this, however, he did not succeed; but he succeeded in making two reflectors with his own hands, which he presented to the Royal Society in 1672, the great speculums of both being of a spherical figure, although he was fully aware of the superiority of the parabolic form. During the interval he was employed in making his reflectors, he tried his hands upon constructing a refracting telescope which had been prepared by Descartes, the object of which was to *grind* the

lenses into one of the figures of a conic section; and when employed in this pursuit, he made his grand discovery of the various refrangibility of the rays of light, from which he concluded, that the errors arising from the spherical figure of the lens were small in comparison with those which arose from refrangibility. He therefore gave up the attempt of constructing refracting telescopes, considering that the divergency of the rays of light, arising from the difference of their refrangibility, was always in proportion to the refracting powers of the medium. In consequence of this opinion of Sir Isaac Newton respecting refracting telescopes, all attempts to construct them free from the effects of refrangibility were, for a period of nearly seventy years, laid aside. However, some time about the year 1753, Mr. John Dollond, after many optical experiments, discovered that the refractions of two prisms, when made of different kinds of glass, might be equal, and that the difference of their refrangibility might be considerable; and that there might be equal divergency with different degrees of refraction; in short, that refraction might be produced without colors. Acting from these principles, Mr. Dollond was the first artist that produced a correct achromatic refracting telescope. And here I will ask Mr. Cheverton, if the odium, which he attaches to Euler on this head, ought not on all these accounts to have been fathered upon Newton?

I wait for his reply. I have lots more in store for him.

I am sir, yours, &c,

LEWIS FRIEND.

St. John's Wood, Aug. 9, 1834.

A Few More Words in Behalf of Mathematical Science.

[From the London Mechanics' Magazine.]

Mr. EDITOR,—As I find I must be absent from London for two or three weeks, I will not have an opportunity during that time, of continuing my appeal in behalf of mathematical science; and as my last short article will hardly be a mouthful for your highly gifted correspondent, Mr. Cheverton, I beg leave to give him one morsel more before I take my departure.

LEWIS FRIEND.

St. John's Wood, Aug. 17, 1834.

Notwithstanding the opinion expressed by Sir I. Newton on the effects of refrangibility on the refracting telescope, Euler, it appears, (although a rigid disciple of the Newtonian philosophy,) was not satisfied; for we find that in 1747 he tried to prove the possibility of destroying the effects of colors on the focal image, by imitating the structure of the eye, which he considered to be the most perfect of all optical instruments.* He proposed to construct a convex lens, having its cavity filled with water, from which he expected to produce distinct vision, freed from the effects of refrangibility, and also from the aberration produced by the spherical figure of the lens. He, however, did not altogether succeed—in all probability for the same cause that Gregory failed. In truth, he was not a practical optician; pure intellect was the region of all his speculations. In 1752, Mr. John Dollond communicated to the Royal Society of London, a paper endeavoring to show that the principles advanced by Euler were quite at variance with those deduced from Sir I. Newton's experiments on the refrangibility of light; although, at the same time, it was doubtful if either the one or the other of their theories were consonant with the laws of nature. On this subject the scientific world were much divided in their opinions. At last Mr. Dollond, in order to satisfy himself, had recourse to experiments, the result of which was, that he found that he was wrong himself, and that Euler was right. Being thus cured of his former prejudices, although not liking the expedient of enclosing water in the lens, he at last, after four or five years of fatiguing research, succeeded in constructing an achromatic refracting telescope, in the way mentioned in my first article. And here, Mr. Editor, I cannot help thinking, that although Euler did not succeed, still the discoveries he made as to the method of destroying the errors arising from the effects of colors on the extremities of the focal image were the means of directing Mr. Dollond in his construction of the first refracting telescope, which he produced in the year 1757. However, be that as it may, he was more fortunate than Mr. James Gregory; he lived to see, and was one of the first to congratulate Mr. Dollond on his great achievement. He was too much of a sage to indulge in any peevish reflections on this seeming triumph of Mr. Dollond. Different was the fate of Mr. James Gregory: he did not live to see a construction of his reflector, according to his own principles, although Newton with his own hands had attempted it. However, in 1724, Mr. James Short, a first rate artist, and highly celebrated for his mathematical and astronomical at-

* I do not know what Euler's opinion on this head might have been 19 years afterwards, when, unfortunately for himself and science, he became totally blind.

tainments, succeeded in constructing a telescope according to the principles of the first inventor.

What Mr. Cheverton means when he says that the most valuable method of determining the longitude is by means of the telescope constructed upon the principles of Mr. Dollond, I am at a loss to guess. Does he mean that of finding the longitude at sea?* If so, I am compelled to inform him that he knows nothing about the matter. Hadley's reflecting quadrant and sectant, as improved by Ramsden's dividing engine, must rank as one of the greatest mechanical discoveries that ever was made in aid of nautical (or, I might add, practical,) astronomy. It is now universally used at sea for determining the longitude. While mentioning the names of Dollond, Short, Hadley, and Ramsden, those of Graham and Bird ought not to be forgotten; they equally distinguished themselves in their various mechanical and optical discoveries. The only charge that can be brought against them that can diminish their reputation in Mr. Cheverton's estimation, is that they were all more or less addicted to the useful studies of geometry and astronomy. Indeed, I have heard that one of them (whose name perhaps it would be improper to mention) indulged himself in the sinful practice of acquiring a knowledge of the higher analysis.

I shall have yet something further to say at a future opportunity; meanwhile, I beg to subscribe myself, Mr. Editor, your very obedient servant, LEWIS FREND.

History of Astronomy—its various Systems, &c. [Continued from page 220.]

After the 20th of March the sun appears to rise every day sensibly more to the northward than he did the day before, to be more elevated at mid-day, and to continue longer above the horizon, till the 21st of June, which is the longest day at all places in the northern hemisphere. At this time the angle formed by the northern half of the earth's axis, and the line joining the centre of the earth and the sun, is then at the least, which is 66½ degrees. The sun will then appear to touch the tropic of Cancer, and be vertical to all places 23½ degrees north of the equator. This time of the year is called the *summer solstice*, because it is the middle of summer, and the sun seems to remain stationary for a few days.

After the 21st of June, the angle joining the centres of the earth and sun gradually increases, and the sun appears to recede from the tropic of Cancer, in the same manner as he advanced to it, rising every day a little farther to the south than he did the day before, till the 23d of September, when the axis has a similar position to what it had on the 20th of March, being again at right angles to the line just mentioned, consequently the days and nights are again equal all over the globe, which constitutes the *autumnal equinox*.

The sun now appears to cross the equinoctial; and the south pole, which, during the last six months, was in the dark, begins to turn towards the sun; and precisely the same phenomena are exhibited to the southern hemisphere as those already described in the case of the northern half of the earth. On the 22d of December the sun appears to touch the tropic of Capricorn, and is vertical to all those places on the earth that are 23½ degrees south of the equator. The days are then longest at all places in the southern hemisphere, but at the shortest in the northern. This time of the year is termed the *winter solstice*.

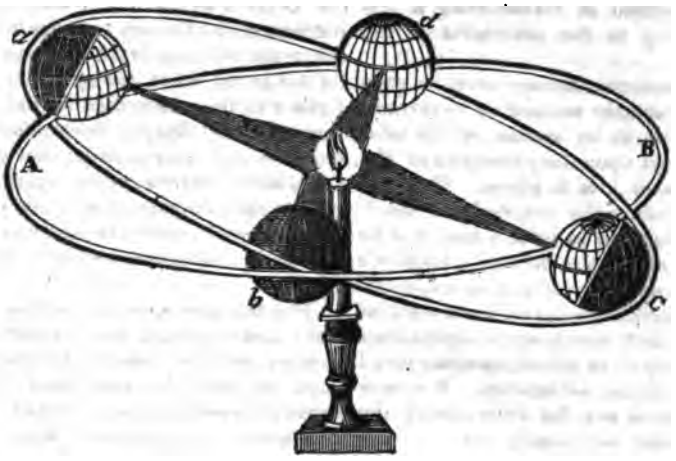
From the tropic of Capricorn the sun appears to move forward, and to arrive at the equinoctial on the 20th of March.

Thus, by a combination of the *annual* and diurnal motions of the earth, with the parallelism of its axis, and the obliquity of its orbit to the plane of its equator, the various seasons are produced, and the same quantity of light and darkness, in the space of a year, are distributed to every region of the globe.

The manner in which the sun enlightens the earth, the parallelism of its axis, and the increase and decrease of the days and nights, may be well illustrated by a small terrestrial globe, suspended by a string fastened to its north pole, as represented by the following figure. [See next page.]

A circle of wire, A B, representing the plane of the earth's equator, may be held parallel to a table, and equal in height with the flame of a candle standing upon it. If the string be twisted a little towards the left hand, and the globe suspended within the circle, with its equator at the same height, the globe will begin to turn on its axis from west to east, and day and night will be represented by the light and shade produced by the candle on its surface. But if the globe be carried round the wire, to represent a year, the candle will illuminate both poles, and every spot on its surface will describe half a circle in the enlightened part, and half in the dark part, and make equality

* The writer of this article has had considerable practice, both at sea and land, in taking and working lunar observations.



of day and night through the year. This is, however, not the case in nature, as has already been fully explained. If, then, the wire be inclined to the table at an angle of 23½ degrees, as represented by the circle *a b c d*, and the globe be carried gently round it, the seasons, and increase of day and night, will appear as they are in nature; that is, when the globe is at *a*, the candle enlightens it no farther northward than the arctic circle, *n o*, all within which, in the middle of our winter, is deprived of a sight of the sun, while all places within the antarctic or opposite circle have perpetual day: at this time the candle shines vertically on the tropic of Capricorn. As the earth moves towards *b* (the vernal equinox), if a small patch be laid on latitude 51½° north, it will show how the days increase at London, and how the nights decrease. When it has arrived at *b*, the candle will then be perpendicularly over the equator, and, shining to both poles, equality of day and night will take place: as it proceeds towards *c* (the summer solstice), the days increase, and the candle shines more and more over the north pole: when it has arrived at *c*, the whole arctic circle, and the countries it includes, will revolve in continual sight of the sun, and all within the antarctic circle will be deprived of that sight. At this time the candle shines vertically on the tropic of Cancer. Moving from midsummer towards *d* (the autumnal equinox), the days will be found to decrease, and the nights to increase in length, till they come again to equality at *d*, and thence to the winter solstice, and so on.

The particular temperature which distinguishes each of the seasons at any particular place is owing to a difference in the sun's altitude, and the time of his continuance above the horizon of that place. In winter the rays of the sun fall so obliquely, and the sun is such a short time above the horizon, that his influence in heating the earth is but very little, compared with what it is in summer. For at this season the sun is so much higher than in winter, that his rays not only fall more perpendicularly, but more of them fall on any given space; and as the day is also much longer than the night, the temperature of the earth and the surrounding atmosphere must be much greater than in winter.

Since the power of the sun is greater in heating the earth at any particular place, when his rays fall most directly, and when the days are longest at that place, it may be asked how does it happen that the heat is greatest about the end of July, when the sun is highest and the day longest about the 21st of June? The reason of this may easily be discovered by attending a little to the manner in which bodies are heated. The heat which the earth receives is not transient, but is retained by it for some time; for, like other solid bodies, it receives heat and parts with it gradually. Now, as the earth continues to receive more heat in the day than it gives out in the night, for a considerable time after the 21st of June, its temperature will continue to increase, till the days and nights begin to approach to an equality. But this is not the case till the end of July at least; the earth goes on increasing in temperature, till about this time,* when it is found to be much greater than about the 21st of June, although the sun be then higher at mid-day, and the day longer, than at any other time of the year in the

* The same phenomena takes place in the southern hemisphere in a reverse order, or at six months difference of time.

northern hemisphere. The heat in July would be still greater were the sun at his mean distance from the earth; but this is not the case, for he is then at his greatest distance. However, the difference between his distance at this time and the mean distance being only one sixty-fourth part of the whole, it could not make a great alteration in the heating power of the rays. But if it does operate in any degree in diminishing the heat in the northern hemisphere in July, the same cause must operate in increasing the heat, but in a double degree, in the southern hemisphere in January. For the sun is one sixty-fourth part nearer the earth than his mean distance on the 1st of January. Consequently the heat must be greater in the southern hemisphere in January than in the northern in July, all other circumstances being the same. The effect of the direct influence of the sun is, however, greatly modified by the transportation of the temperature of one region into another, in consequence of that disturbance in the equilibrium of the atmosphere which the action of the sun's rays necessarily produce.

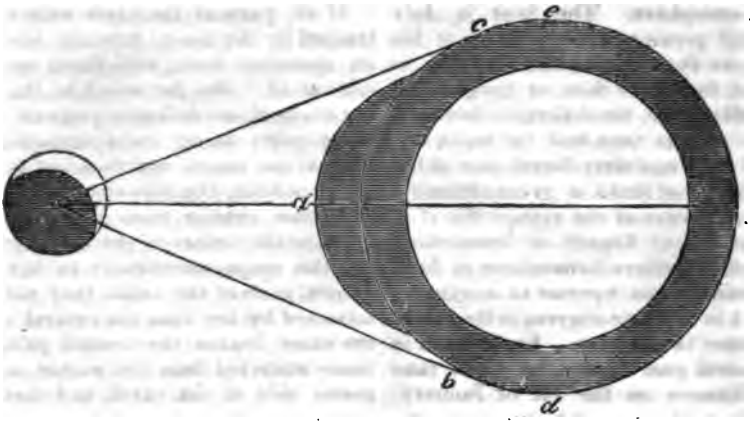
Thus we see by what simple means the whole variety of the seasons are produced; and also how admirably fitted the means are to accomplish the end.

Of the Tides.—The tides have always been found to follow, periodically, the course of the sun and moon; and hence it has been suspected, in all ages, that the tides were some way or other produced by these bodies.

The celebrated Kepler was the first person who formed any conjectures respecting their *true* cause. But what Kepler only hinted, has been completely developed and demonstrated by Sir Isaac Newton.

After his great discovery of the law of gravitation, he found it an easy matter to account for the whole phenomena of the tides; for, according to this law of nature, all the particles of matter which compose the universe, however remote from one another, have a continual tendency to approach each other, with a force directly proportional to the quantity of matter they contain, and inversely proportional to the square of their distance asunder. It is, therefore, evident from this, that the earth will be attracted both by the sun and moon. But although the attraction of the sun greatly exceeds that of the moon, yet, the sun being nearly four hundred times more distant from the earth than the moon, the *difference* of his attraction upon *different* parts of the earth is not nearly so great as that of the moon; and therefore the moon is the principal cause of the tides.

If all parts of the earth were equally attracted by the moon, it would always retain its spherical form, and there would be no tides at all. But the action of the moon being unequal on different parts of the earth, those parts being most attracted that are nearest the moon, and those at the greatest distance least, the spherical figure must suffer some change from the moon's action. Now, as the waters of the ocean directly under the moon are nearer to her than the central parts of the earth, they will be more attracted by her than the central parts. For the same reason the central parts will be more attracted than the waters on the opposite side of the earth, and therefore the distance between the earth's centre and the waters on its surface, both under the moon and on the opposite side, will be increased; or the waters will rise higher, and it will then be flood or high water at those places. But this is not the only cause that produces the rise of the waters at these two points; for those parts of the ocean which are 90° from them will be attracted with nearly the same force as the centres of the earth, the effect of which will be a small increase of their gravity towards the centre of the earth. Hence, the waters at those places will press towards the *zenith* and *nadir*, or the points where the gravity of the waters is diminished, to restore equilibrium, and thus occasion a greater rise at those points. But, in order to know the real effect of the moon on the ocean, the motion of the earth on its *axis* must be taken into account. For if it were not for this motion, the longest diameter of the watery spheroid would point directly to the moon's centre; but by reason of the motion of the whole mass of the earth on its axis, from west to east, the most elevated parts of the water no longer answer precisely to the moon, but are carried considerably to the eastward in the direction of the rotation. The waters also continue to rise after they have passed directly under the moon, though the immediate action to the moon begins there to decrease; and they do not reach their greatest height till they have got about 45° farther. After they have passed the point which is 90° distant from the point below the moon, they continue to descend, although the force which the moon adds to their gravity begins there to decrease. For still the action of the moon adds to their gravity and makes them descend till they have got about 45° farther; the greatest elevations, therefore, do not take place at the points which are in a line with the centres of the earth and moon, but about half a quadrant to the east

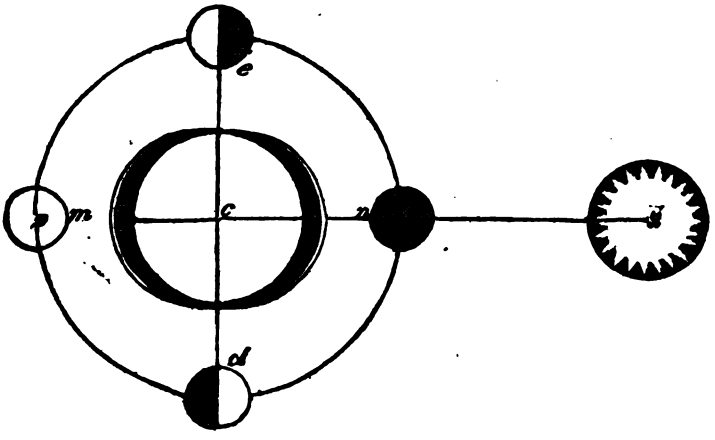


of these points, in the direction of the motion of rotation.

Thus it appears, if the earth were entirely covered by the ocean, as represented by the circle *b d e c* in the preceding figure, that the spheroidal form which it would assume would be so situated that its longest diameter would point to the east of the moon, or the moon would always be to the west of the meridian of the parts of greatest elevation. And as the moon apparently shifts her position from east to west in going round the earth every day, the longer diameter of the spheroid following her motions will occasion two floods and two ebbs in the space of a lunar day, or 24 hours 48 minutes.

These are the effects produced by the action of the moon only; but the sun has also a considerable effect on the waters of the ocean. But it is not the action of these bodies on the earth, but the inequalities of their actions, which produce these effects. The sun's action on the whole mass of the earth is much greater than of the moon's; but his distance is so great, that the diameter of the earth is a mere point compared with it; and therefore, the difference between his effects on the nearest and farthest side of the earth becomes on this account vastly less than it would be if the sun were as near as the moon. However, the immense bulk of the sun makes the effect still sensible, even at so vast a distance; and although the action of the moon has the greatest share in producing the tides, yet the action of the sun adds sensibly to this effect when his action is exerted in the same direction, as at the time of *new* and *full moon*, when these two bodies are nearly in the same straight line with the centre of the earth. When this is the case, the effects of these two bodies are united, so that the tides rise higher than at any other time, and are called *spring tides*, as represented by the following figure, where S denotes the sun, *d n e z* the moon, and *c* the earth.

The action of the sun diminishes that of the moon in the *quarters*, because his action is opposed to that of the moon; consequently the effect must be to depress the waters where the moon's action has a tendency to raise them. These tides are considerably



lower than at any other time, and are called *neap tides*.

The *spring tides* do not take place on the very day of the new and full moon, nor the neap tides on the very day of the quadratures, but a day or two after; because in this case, as in some others, the effect is neither the greatest nor least when the immediate influence of the cause is greatest or least: as the greatest heat, for example, is not on the solstitial day, when the immediate action of the sun is greatest, but some time after it. And although the action of the sun and moon were to cease, yet the ocean would continue to ebb and flow for some time, as its waves continue in violent motion for some time after a storm.

The *high water* at a given place does not always answer to the same situation of the moon, but happens sometimes sooner and sometimes later than if the moon alone acted on the ocean. This proceeds from the action of the sun not conspiring with that of the moon. The different distances of the moon from the earth also occasion a sensible variation in the tides.

When the moon approaches the earth, her action in every part increases, and the difference in that action, upon which the tides depend, likewise increases. For the attraction of any body is in the inverse ratio of the square of its distance; the nearer, therefore, the moon is to the earth, the greater is her attraction, and the more remote, the less. Hence, her action on the nearest parts increases more quickly than it does on the more remote parts, and therefore the tides increase in a higher proportion as the distance of the moon diminishes.

Sir Isaac Newton has shown that the tides increase as the cube of the distances decrease, so that the moon, at *half* her present distance, would produce a tide *eight times* greater. Now, the moon describes an ellipse about the earth, and, of course, must be once in every revolution nearer the earth than in any other part of her orbit; consequently, she must produce a much higher tide when in this point of her orbit than in the opposite point.

This is the reason that two great *spring tides* never take place immediately after each other; for if the moon be at her least distance at the time of new moon, she must be at her greatest distance at the time of *full moon*, having performed half a revolution in the intervening time, and therefore the spring tide at the *full* will be much less than that at the preceding *change*. For the same reason, if a great spring tide happens at the time of *full moon*, the tide at the following *change* will be less.

The spring tides are highest and the neap tides lowest about the beginning of the year; for the earth being nearest the sun about the 1st of January, must be more strongly attracted by that body than at any other time of the year; hence, the spring tides, which happen about that time, will be greater than at any other time. And should the moon be new or full in that part of her orbit which is nearest to the earth, at the same time the tides will be considerably higher than at any other time of the year.

The tide which happens at any time while the moon is above the horizon is called the *superior tide*, and the other the inferior tide. When the moon is in the equinoctial, other things remaining the same, the *superior* and inferior tides are of the *same* height; but when the moon declines towards the elevated pole, the *superior* tide is higher than the *inferior*. If the latitude of the place and the declination of the moon are of contrary names, the *inferior* tide will be the highest. But the highest tide at any particular place is when the moon's declination is equal to the latitude of the place, and of the same name; and the heighth of the tide diminishes as the difference between the latitude and declination increases; therefore, the nearer any place is to that parallel whose latitude is equal to the moon's declination, and of the same name, the higher will the tide be at that place.*

Such would the tides regularly be if the earth were all covered over with the ocean to a great depth; but as this is not the case, it is only at places situated on the shores of large oceans where such tides as above described take place.

The tides are also subject to very great irregularities from local circumstances, such as meeting with islands, shoals, headlands, passing through straits, &c. In order that they may have their full motion, the ocean in which they are produced ought to extend 90° from east to west, because that is the distance between the greatest elevation and the greatest depression produced in the waters by the moon. Hence it is that the tides in the Pacific Ocean exceed those of the Atlantic, and that they are less in that part of the Atlantic which is within the torrid zone between Africa and America, than in the temperate zones, on either side of it where the ocean is much broader.

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* In comparing the height of the tides at different places, it is supposed that the sun and moon are at the same distance from the earth, and in the same position with respect to the meridian of these places.

In the Baltic, the Mediterranean, and the Black seas, there are no sensible tides; for they communicate with the ocean by so narrow inlets, and are of so great extent, that they cannot speedily receive and let out water enough to raise or depress their surfaces in any sensible degree.

The power of the moon to raise the waters, Sir I. Newton has shown to be about 4½ times that of the sun, and that the moon raises the waters 8 feet 7 inches, while the sun and moon together raise them 10½ feet, when at their mean distances from the earth, and about 12 feet when the moon is at her least distance. These heights are found to agree very well with observations on the coasts of open and deep oceans, but not well on the coasts of small seas, and where the water is shallow.

The mean retardation of the tides, or of the moon's coming to the meridian in 24 hours, is 48′ 45″·7, and the mean interval between two successive tides is 12h. 25′ 14″·2; hence the mean daily retardation of high water is 50′ 28″·4.

About the time of *new* and *full* moon the interval is least, being only 12h. 19′ 28″; and at the quadratures the interval is the greatest, being 12h. 30′ 7″.

The common method of calculating the time of high water at any place is to multiply 50′ 28″, or the mean daily retardation of the tides, by the moon's age, and then to divide the product by 60, which gives the mean time of the moon coming to the meridian on that day in hours; to this is added the time of high water on the days of *full* and *change* at the given place, and the sum is the time of high water at that place on the *afternoon* of the given day, if the sum be less than 12 hours; but if greater, 12 hours 25 minutes must be subtracted, in order to have the time on the afternoon of the given day; and 25 minutes subtracted from this time will give the time of high water on the morning of the given day.*

The Study of Natural History in Common Schools.

A revolution of vast importance to the intellectual progress of children seems to have commenced in the common school system of the past age, both of this and some other favored countries, which introduces youth to an early acquaintance with the elements, at least, of a series of studies that were once unwisely supposed of no interest or consequence to them. That philosophy which provides resources for the active powers of the mind—which contemplates the physical organization of the body, and exerts a magnetic influence over the first independent inquiries of a human being, and, in its operations, elevates the character, and at the same time lays a broad and sure foundation for usefulness in this, and immortal happiness in another state of existence, must, indeed, recommend itself to every well-wisher of our race. Such seems to be the fact in relation to the new modes of action, which have resulted in a combined effort, certainly in New-England, to raise the standard of what is denominated a common education.

Children are by no means so destitute of thought as some may have ignorantly supposed; the machinery of their frames is no less in order for movement than their minds are vigorous and expansive. But to reduce the train to an orderly arrangement, and to direct those intellectual rays which, from the very structure of those organs through which external impressions are made, tend to aberrations, to luxuriance, and to monstrosity, calls upon the philanthropic instructor for uncommon exertions in the commencement of their pupilage.

Every man who has become at all interested in the prodigious efforts now making, for improving or perfecting the plan of early education, so auspiciously commenced, feels the necessity of superadding something else to the catalogue of indispensables to perfect the system, so that there is actual danger of building up an unwieldy and inconvenient edifice, that will, by and by, fall by the weight of its own massive materials. It is possible that we may be actuated by the same spirit of improvement which has been deprecated in others, as it is the principal object of this essay to call the attention of instructors to the consideration of a particular department of study, which has yet no place in the school. It belongs to one of those departments of knowledge which has employed the devoted talents of the greatest men, and in the sequel, irresistibly conducts the student from earth to things of heaven, and to Him who framed the universe. The subject to which this allusion is made is Natural History, not in its greatest latitude, embracing all animated nature, but a particular department of that curious and captivating subject, which explains the laws of animal life, the physiology and functions of individual organs, the habits, instincts, and localities of animals, and lastly, classification, by which is understood the reason for grouping them in tribes or families.

* This method is far from being exact; but affords an approximation, which may be useful on some occasions. When accuracy is wanted, recourse must be had to other methods.

That there will be objections to grafting this scion on the incipient tree of knowledge cannot be doubted; not because the subject is of an undignified or insignificant character, but from an apprehension that the capacities of children are incompetent to the investigation of such grave and all-absorbing topics. The food that recommends itself to the palate of the epicure, certainly, would not be invariably ungrateful to the less pampered appetite of a temperate liver. Enjoyment, arising from an accumulation of useful knowledge, surely cannot be less exciting to the child than to the profoundest philosopher of the age. Again: in what way can the child more readily become interested in the multitude of objects by which he finds himself surrounded, than by gratifying his natural desire for solving the why and the wherefore, in relation to the figure, economy, and propensities of those animals of which he entertains an instinctive fear? Even the infant is inquisitive to know why the dog has pointed teeth, or the cat sharp claws; why the bird has a bill and wings, instead of hands. Moreover, as the strength and majesty of the mind solely depends on its ceaseless activity in the right field of observation, something more than the pap of vulgar notions about giants and talking bears is indicated, in the present state of society, to prepare the intellectual faculties for receiving those solid, those truly substantial lessons which can alone fit the child for becoming a useful member of modern society.

In our happy times, muscular strength gives the individual no claim to admiration, with well-bred people; agility in wrestling, at tilts and tournaments, in daring feats of war, even when heroes are exhibited, have but an ephemeral applause; but the mighty achievements of the mind are enduring, and those who never reverenced one of their own species because he swayed a sceptre, have willingly paid homage to the superior moral and intellectual attainments of their fellow men.

It is principally because the elements of natural history are particularly captivating, from infancy to age, that the philosophical instructor should avail himself of its power to enlarge and strengthen the capacity of the child. Moreover, the study of this important branch of knowledge actually embraces within its circle, or calls in for illustration, most, if not all those sciences, the possession of which exalts man, and gives additional lustre to his intellectual character. Children are unsatisfied with the mere gratification of the eye. Though they may admire or be alarmed at the sight of beings whose physical organization differs essentially from their own, still an interrogatory follows. Who made it? where did it come from? will it bite? what does it eat? and whose is it? are the invariable questions that succeed any exhibition of animals, whose figure, or external characteristics, are not exceedingly familiar. Who will not acknowledge, then, if there is a branch of important information, useful and ennobling in riper years, so exciting to children, even in its crudest form—who would not admit the possibility of converting it into an instrument of singular force, which, while it amused, would also instruct, and give direction to those mental emanations so important to the well-being of society?

If the child is taught that there is a connecting link in the series of animated beings, and that the machinery by which the principle of life is sustained becomes more and more complicated as the series advances towards the physical perfectibility of man, it will assuredly exalt their ideas of the character of God, who demonstrates his omnipotency in calling them into existence, and his infinite skill, in adapting each family, however marvellous its configuration, to the precise condition of the locality it was expressly designed to occupy. It is idle to teach the child that 'order is heaven's first law,' without striking illustrations of the truth of the declaration. A pebble, a beautiful plant, or a star twinkling in the firmament, may each be referred to in explanation of the position, but they will fail to impress the dawning mind with any lasting remembrance of the Creator's power. But an animated being, moving its limbs, and showing its positive activity, independently of surrounding objects, never fails to develope the strongest interest. How can the principles of physiology, which treats expressly of the functions of individual organs, reach the understanding of children, without some correct information on the natural history of the common tribes of animals, including themselves! It were a waste of labor to make the attempt.

To produce the best results, and lay a permanent foundation for the study of natural history, in the case of children, it is obviously important to introduce them to the rudiments of anatomy. We would not be understood to leave the impression that any thing more than an approximation to that valuable science should be attempted. Thus, it might be said that all animals, for example, have bones, as the horse, the ox, dogs, and fishes; and subsequently, it should be men-

tioned that, although all animals have skeletons, some of them have their bones, or that which is equivalent, on the outside instead of the inside of their bodies, in the form of a shell, as, for example, the lobster, the oyster, and some others. Again, another preparatory step of more vital consequence than might at first be admitted, in the course of elementary education, is the fact, that it would be regarded, in the sequel, as highly curious, that every animal, whether large or small, has blood circulating through an almost infinite number of hollow tubes, laid like aqueduct pipes, all over their bodies. Bones, therefore, imply blood, because the one would never have been produced without the presence of the other. One of these simple truths exercises the mind, inasmuch as a reference is actually made to the other; hence comparison, and those modifications of primitive ideas, which eventuate in the production of a train of thought, and of knowledge, by the process of reasoning.

There being blood and bones, two essential constituents of an animal frame, it implies, in the third place, an organ in which the material of which both are constituted is elaborated. Here, then, it is necessary to explain the stomach, and, at the same time, show that it is a receptacle of food. Food, therefore, of whatever kind, being introduced into the stomach, is converted first into blood, and out of that the bones are formed. To these first impressions, the judicious instructor will append other remarks, explanatory of the first principles of vitality, but they should never pursue details that might rather confuse than enlighten the infantile mind. To know any thing certainly, all experience shows that the lesson should be a plain statement. Deductions naturally grow out of them, for such is the constitution of mind, whether in the babe or the philosopher, that it seeks out new sources of gratification, by revolving the primitive idea. Bones, &c. being necessary for animals, induces the child to exercise its latent reason, and it next arrives at this conclusion: Their limbs are inflexible, because there are bones in them; and the finger bleeds, because the blood is always running in the hollow vessel which has been wounded; animals eat, too, because some more blood must be manufactured, or else their bones would not grow, and so on. Such are the invariable operations of the child's mind, when the impetus has been given by any particular systematic course of instruction.—[Scientific Tracts.]

MECHANIC POWERS.—An experiment was made at Brussels on the 16th, at the house of the mechanician Lemaire, *rue de l'Eskylier*, No. 10, with a machine moved by a force not hitherto employed in mechanics. That force is Galvanism, which developes the magnetic property of iron. The new machine is composed of a flying (*volant*) horizontal wheel of copper, in the plane of which is placed a bar of iron, rendered magnetic by a galvanic pile. The bar carries round the wheel between two fixed magnets, but as soon as the ends of the bar reach the points of equilibrium, the electric current changes its relations, and replaces by repulsion the attraction which directs the bar. The latter, in consequence of the accelerated motion it has acquired, passes the position of equilibrium, and continues its rotary motion in the same direction. The experiment had complete success. The machine moved upwards of an hour, and its accelerated motion excited hopes that it may be ere long employed to move considerable masses. The great magnetic energy given to magnetism by a galvanic current is already well known, and be that, however, as it may, mechanics will henceforth be in possession of a new power. The machine, constructed with great care and success by Lemaire, was the invention of a Professor of Brussels, M. Guillery.—[Courrier Francaise, Aug. 4, 1834.]

It may be made a question, whether the machine put into operation at Brussels can, with strict propriety, be designated a new mechanic power, whatever may be the useful purposes to which it may be applied. The latter is, indeed, the only important subject of inquiry as regards that or any other invention or discovery.

Is there not a real and long known mechanic power, which has yet never been enumerated amongst those so entitled? We answer, there is such a power, and it is the pendulum. And more, the pendulum is the *power* of all others by which the greatest weight can be raised and moved by the least *force*. In many situations also, the pendulum could be applied to great effect, as, for instance, in stone quarries, in warehouses, to facilitate innumerable operations, in the lading and unlading vessels at wharves, &c.

Though simple in itself, very few persons reflect that in moving a pendulum, every point in it is actually raised, as the axis is a radius of a circle, the centre of which is the point of suspension. The pendulum again is a power admitting the aid indefinitely of accelerated motion, admitting, however, that moving on the principle of the sling, as the motion would be accelerated, a centrifugal

force would be produced in direct ratio with the rapidity given to the machine.

These hints on the pendulum are thrown out as recalled to the mind of the writer when translating the account of the Belgian machine, and may have been, and probably actually have been, suggested by others, as the subject seems too obvious not to have occupied minds engaged on the subject of mechanic forces.—[Nat. Intel.]

Spontaneous Combustion.—There is no science in which more wonders are displayed, or which is so intimately connected with every thing we do, as chemistry; the farmer, the painter, are indebted to chemistry—even the cook cannot boil a potato without chemistry having a hand in it: and there is hardly any branch of it more wonderful than that of spontaneous combustion, by which one or both of the bodies, either animate or inanimate, are consumed by fire, which is at times apparent, and at others not. Becker was the first who discovered the singular effect produced by mixing oil of vitriol (sulphuric acid) with oil of turpentine: he found that when the two perfectly cold liquids were mixed together (about a drachm each) they burst into a flame. Borrichois has, however, proved that aqua fortis produces the like effect; and it has since been discovered that spirits of nitre and sassafras elicit flame in a similar manner. Spirits of nitre, and any of the essential oils in bottles, ought therefore never to be kept together where they are likely to get broken, as they will infallibly inflame when they come in contact with each other. The quantity given for performing the experiment is one drachm of each; but it would require more of that which is sold in the shops, on account of its inferior quality. Every person is well acquainted with the most common existence of spontaneous combustion —that of stacks of corn or hay catching fire. If you ask a farmer why his stack caught fire, he will tell you, "Because it was carried too green;" in other words, because it was not sufficiently dry. But if you should ask him why its being carried too green occasioned its catching, (or firing, as it is termed,) he will be unable to tell you; but chemistry instructs us it is from the heat which is generated by the fermentation produced by the moisture or sap which it contained. Gunpowder magazines, paper-mills, barns, rag warehouses, &c. have frequently been burnt by the same principle—"spontaneous combustion." Another instance of it, not unknown to our readers, is the common fire boxes, such as the Promethean; and yet another, in every day practice, is the lately invented mode of obtaining light by pouring a jet of hydrogen gas on spongy platinum. The article is called by various names. In the windows of chemists may be seen a figure of a little comical looking old fellow, in bronze, on a piece of wood, placed on the top of a glass tube, about three inches in diameter, blowing through a tube from his mouth, with both his hands on a metal cap. The hydrogen gas is made by pouring an equal quantity of sulphuric acid and water on zinc. It was first invented by Professor Dobereiner, of Jena, in 1824. Galen informs us that pigeons' dung, when it has become rotten, will set fire to a house; and it is reported that the great church of Pisa was burnt down by the spontaneous combustion of the dung of pigeons, which had built there for centuries; but as very few of our readers have kept pigeons for a century, there cannot be much danger from that cause! Another instance of spontaneous combustion is that of powdered charcoal. No fewer than four cases of fire have occurred in France from that cause within the last thirty years; for when charcoal is reduced to powder by trituration in tuns with bronze bruisers, it is so fine that it has the appearance of an unctious fluid, and in that state occupies three times less room than in rods above six inches long. It absorbs air much more readily than in rods; this absorption, which is very slow, is accompanied by a disengagement of heat, which rises from 340° to 360° of Fahrenheit, and which is the true cause of the inflammation. But the most wonderful example is that of animal spontaneous combustion. There is an instance mentioned in the Transactions of the Society of Copenhagen, in 1692, of a woman of the lower class, who had been in the custom of drinking spirits to such an extent that she could hardly take any nourishment unless with a quantity of liquid. Having one night gone to sleep on a straw chair, she was discovered in the morning consumed so that no part was to be found, except the skull and the extreme joints of the fingers; all the rest of the body was reduced to ashes. John de Viana relates that the wife of Dr. Frielas, physician to the Cardinal de Royas, Archbishop of Toledo, emitted by perspiration an inflammable matter of such a nature, that when the ribband which she wore next to her person was taken from her and exposed to the air, it shot forth like grains of gunpowder. The Rev. Joseph Beamchini, prelate in the city of Verona, gives a very curious description of the Countess Cornelia Zangara, of Cesena, who was consumed by

an internal combustion in the sixty-second year of her age. He relates that she retired to bed as usual in perfect health, and in the morning was discovered by it consumed to ashes; her legs, with the stockings, remained unburnt, with the head half burnt lying between them, and the air in the room charged with floating soot. It was ascertained that when unwell she was in the habit of washing her body with camphorated spirits of wine. But these effects are not always confined to man; for in the time of the Roman consuls Gracchus and Juventius, a bull is said to have actually emitted flames from his nostrils without suffering any injury: and many more instances, too numerous to mention, place animal spontaneous combustion beyond a doubt; but, in general, it is found to occur in persons who have been addicted to drinking spirits.—[Literary Gazette.]

Telegraph Science. — The increasing utility of this very interesting science has become a subject of considerable notoriety. From an authenticated statement of the annual reports of the establishment at the observatory on Central wharf, in this city, the following results are communicated for the information of its numerous patrons.

Vessels telegraphed from 1824 to 1825, ...	799
" 1825 to 1826, ...	897
" 1826 to 1827, ...	923
" 1827 to 1828, ...	1010
" 1828 to 1829, ...	1309
" 1829 to 1830, ...	1435
" 1830 to 1831, ...	1583
" 1831 to 1832, ...	1809
" 1832 to 1833, ...	1856
" 1833 to 1834, ...	1922
Total number announced by telegraph, . . .	13,543

We understand that, during the above period, fifteen hundred sail of vessels, including the government vessels of war and the revenue cutters, have adopted the use of the telegraph flags.—[Scientific Tracts.]

Food.—By the experiments of Dr. Beaumont, it has been satisfactorily proved that from whatever is introduced into the stomach, the same article is invariably elaborated, whether animal or vegetable, tough or tender, it matters not; the result is the same, under all circumstances, when the digestive process is properly carried on. In the vicinity of Hudson's Bay, one of the exploring party, in those inhospitable regions, says he visited a cabin, one evening, when the inmates were at supper, which consisted of raw flesh of seals, fat, birds and entrails, which constituted a delicious meal. A young girl, the belle of the tribe, was sitting by, biting the inside of a seal to pieces, and distributing the bits to her companions. Train oil, particularly when rancid, is a delicious article, being both meat and drink for Greenlanders. Yet, it is worthy of remembrance, the chyme, the nutritious fluid which nourishes the body, is always the same, whether elaborated from putrid aliments or the most savory viands.—[Ibid.]

Schools in Siberia. — Lancasterian schools were established in Siberia by the late emperor Alexander, which are still well sustained. One thousand boys were taught in them, at the last accounts.—[Ibid.]

"The Society of Civil Engineers has obtained from the Crown a charter of incorporation."

We have inserted the above notice, taken from the last number of the London Mechanics' Magazine, with the intention of devoting the editorial column of this week's paper to a consideration of the importance of a like institution to the cause of internal improvements in our own country.

In a conversation which the editor of this paper had some time since with one of our most scientific engineers, the question was asked, "Why is it that while the character and merit of the different works of Rennie, Telford, Stephenson, Vignoles, and other English engineers, are familiar to most of us here, nothing scarcely is known to them of works in this country, that would not suffer by a comparison with the best of those abroad?" He replied "We want a 'Society of Engineers,' with a suitable periodical to publish their proceedings; and until something of the kind is formed, we shall continue to labor under this disadvantage, that while the members of it have given ample evidence that there is an equal amount of talent and information in the profession here, but little credence will be given to the fact beyond the limited sphere of the directors and company of the work constructed." For the truth of our friend's remark, we can appeal with an honest pride to such works as the inclined planes of the Morris and the aqueducts of the Erie canals. The tunnels, planes, and viaducts of the Allegany Portage, and Baltimore and Ohio railroads, the hydraulic constructions of the Delaware and Raritan, and Delaware and Chesapeake canals, and the thousand other different works to be found on the numerous canals and railroads of our country. We have breakwaters, artificial harbors, aqueducts and reports on aqueducts, bridges, light-houses, dry docks, and wet docks; and, in fact, artificial constructions of every kind, inferior in boldness of conception or skill of execution to but very few of the boasted works of the English or French engineers. If, in a densely settled country like England, with every facility of visiting and becoming acquainted with each other's works, it has been found necessary for the preserva-

tion of the dignity of the profession, and for the dissemination of mutual experience, to form themselves into an incorporated society, how much the more does it become necessary for the profession here to adopt some similar measure. From the comparative paucity of their numbers, they are scattered over an immense section of country, and though, oftentimes two, three, or more works, may from their proximity be under the charge of one person, still from the progress of internal improvement in this country, the profession, from its inadequacy to supply the companies that are daily forming with suitable persons to construct their works, will be daily liable to abuse. Some enterprising carpenter or mason of the neighborhood, becoming possessed of a level and compass, styles himself an engineer, and is forthwith, for want of a better, employed by them as such. That some of our most distinguished engineers have commenced in a like manner, no one is more fully aware than ourselves, yet while, from sound judgment and great ability, they have been enabled to elevate themselves to the highest standing, we are constrained to regard them only as glorious exceptions to the general rule. If the remark is not applicable as a general rule to those who thus commence, why is it, we would ask, that, young as our country is, we already have to lament over so many abortive experiments!

If such an institution as a "Society of Civil Engineers" existed among us, our companies would, as a matter of course, look to its members as the proper persons to which to entrust the charge of their several works. Those entering the profession would naturally connect themselves with some one engineer whose reputation for ability would thus become publicly known, and under whom they could attain that information and experience which would in turn enable them to supply the places that must one day become vacant. That an efficient remedy for the evils we previously stated would be found in such an institution, we firmly believe, and in that belief would cheerfully open our columns for communications on the subject; and as an ardent advocate of the cause of internal improvement, we pledge ourselves that no exertion shall be wanting on our part, that might conduce to carry into effect a measure in which we think the best interests of that cause are so deeply concerned.—[American Railroad Journal.]

Steam Carriages on Common Roads.

UTICA, N. Y., Sept. 26, 1834.

To the Editor of the Railroad Journal:

DEAR SIR,—I take the liberty of sending you for publication, if you think proper, in the Railroad Journal, an extract from a letter just received from a friend in Europe, communicating information upon the important subjects of the explosion of steam boilers and the application of steam to locomotion on common roads. The remarks of the writer are deserving of the more attention, as they are subjects with which he is practically acquainted, and to which for the last few years he has devoted much study and observation. His interview with Mr. Perkins will be read with interest, not only from the high reputation which Mr. P. has acquired as an artist, but from the general success of his labors, in developing the powers and properties of steam, and in various other improvements in science and the arts.

With respect, yours, truly, E. F. J.

"PARIS, August 2, 1834.

"I made considerable inquiry (as you requested) with regard to the application of steam carriages to common roads while in England, but regret that I am not able to give you as favorable an account of the late improvements as you may possibly anticipate.

"You have probably seen the statement published in the London Times some months since, that a carriage, in operation near there, had passed the Royal Mail while ascending at full speed a hill of considerable elevation, and that it had travelled at the rate of 24 miles per hour on a level. You must not, however, conclude that the use of steam is driving the horses from the English turnpikes. The arbitrary coachman has not yet been compelled to abdicate his throne in favor of the more skilful engineer, who has been trained to load a safety valve in lieu of the cockney accomplishment of guiding by the rein or cracking the whip.

"The great weight which, notwithstanding the numerous improvements, is still found indispensable to an engine and boiler of any considerable power, renders it almost impossible to mount it upon wheels, and continue it in rapid motion for any length of time, on as irregular a surface as that of a common road, without serious injury. It must be considered likewise that the effect produced by a given power is small, compared with that upon a well constructed railway, owing to the greater resistance to be overcome, arising from the irregularity of the surface above mentioned.

"Mr. Church's patent steam carriage, constructed to ply between Birmingham and London, is one of the lightest in proportion to its strength, and I think of the best arrangement of any that I had an opportunity of seeing. It has two oscillating cylinders of 50 horse power each, and a small extra engine for supplying the boiler with water when the carriage is at rest. The whole machine weighs four tons, and performs admirably for a short distance, but is subject to the difficulty I have already mentioned. *It is now, like all the others, laid up for repair.*

"Mr. Ericsson (of whom you speak) has not as yet been able, I believe, to prove by actual experiment the advantages of his boiler for using air instead of water for generating power. I sent you from London a number of the Repertory, containing the specification of his patent, and I have not learned that he has made any important improvement since.

"There is a great difference of opinion with regard to the ultimate success of steam carriages among the knowing ones in England. Mr. Church is very confident of success, and is

expending very large sums in experimenting, while Mr. Perkins is of a different opinion. He thinks that very great improvements must yet be made, not only in the boiler, but in the engine, before steam carriages can be applied with any advantage to common roads. He is now experimenting on a rotary steam engine invented by some lord, whose name I have forgotten, which he wishes to apply to the railroad carriage. You know what my views have been on the application of the rotary engine to locomotion for some time past. Pardon my vanity, but I do think the model I showed you some years since is much less liable to friction, and I know less complicated, than his lordship's. The latter moves, however, under the hand of Mr. Perkins, but whether it will economize steam the most, is another question.

"Speaking of Mr. Perkins reminds me of a conversation I had with him a few days before leaving London, on the subject of steam boilers and explosions. He agrees with me in opinion that the theory of collapses is false, and that explosions only occur from the application of too great a pressure, (caused either by too great a reduction of water in the boiler, or by not using the steam as rapidly as it should be,) or from the combustion of a mixture of hydrogen and oxygen gases. He told me that he was perfectly convinced, from recent experiments, that if explosions did occur in the use of his high pressure boiler from the first two causes, no serious consequences would ensue. As a proof of this assertion, he produced several fragments of a boiler, which had been attached to his steam-gun, and which had exploded several times at a pressure of from 400 lbs. to 600 lbs. to the square inch, without injury to the engineer or any of the attendants, or without deranging any part of the machine, except the particular flue, or rather cylinder or tube, that gave way, and which in every case was repaired in one night and ready for action again the next morning.

"He also thinks he has discovered how the oxygen is supplied, which, combined with hydrogen, has produced, beyond a doubt, so many dreadful explosions of the low pressure boilers in our country. You are aware that the disbelievers in the theory of explosions by the combination of gases have founded their faith on the impossibility that any oxygen gas should exist in the boiler. They say that it is impossible for it to find its way there against the pressure of the steam, and that although hydrogen might be formed by the decomposition of the water, yet oxygen could not be. Mr. P. perfectly explains it. It is supplied by the force pump, which, in almost all the American steamboats, is constructed in such a manner as to force in air when it is no longer able to supply water. The water being low, the iron is exposed to the action of the fire, soon becomes red hot, throws off hydrogen, and when a certain quantity of each is produced, the boiler is as certain to explode, as though, when thus heated, it were filled with gunpowder. This, too, explains the reason why the number of explosions in England are so few in proportion to those in the United States. It is not because they have more skilful engineers, or that they are more careful, but because their force pumps are immersed, almost universally, in water, (not from design, but by accident.) They therefore cannot force air into the boiler, although they may not supply it with water. The subject certainly deserves attention. If, by using a boiler like that of Mr. Perkins', the risk of life occasioned by the ordinary explosions can be greatly or entirely diminished, and if, by immersing the force pump in water, the explosion of gases can be entirely prevented, the experiment should be fairly and fully tried.

"I intended to have given you, as well as I was able, a description of the Galley of Practical Arts, in which Mr. P.'s steam gun is placed, which discharges 36 balls per second, and where his press is deposited, with which he compresses water one-twelfth of its bulk. I wished also to speak of his late discovery of making ice at 4 cents per lb., by which he is enabled to produce it at sea to supply the place of fresh water, and to undersell the Boston merchant who ships it to the south, but must defer it to another opportunity; and will close by saying that I leave here to-day in a small paid Diligence, with the prospect of being stopped to show my passport every few miles—the police being particularly strict since Don Carlos passed them so rapidly the other day.

"Yours, as ever, W———."

Canal of Burgundy.—The line of internal navigation, which this magnificent undertaking has at last completed, extends from Havre de Grace to Marseilles, and is of the length of 300 leagues and upwards. It was commenced by the states of Burgundy in the year 1775, continued during the imperial sway of Bonaparte, and resumed in the year 1822. The whole sum expended upon it, from first to last, amounted to 40,000,000 francs, (£1,000,000.) Its actual length from St. Jean de Losne to the village of La Roche, where it meets the Yonne, is 242,572 metres, or 795,830 feet. It is provided with 189 sluices.

A Canal uniting the Rhine with the Rhone, and 246,000 metres (or 807,085 feet) in length, has likewise been opened; it begins at St. Symphorien, where it joins the Saone, and passes into the Rhine at a village called Kilstett, near Strasburg. It has also a branch leading from Mulhausen to Basle. The expense of constructing this canal was much less than that of the canal of Burgundy, as there were fewer difficulties to overcome in forming it.—[English paper.]

The *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. Minor and E. E. Chellis, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum, *in advance*.—John Knight, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING NOVEMBER 8, 1834. [NUMBER 5.

Travelling Balloon, or Flying Machine.

To the Editor of the Mechanics' Magazine:

SIR,—Having lately proposed a plan for employing a balloon for an observatory, I shall now endeavor to describe more minutely the construction of a similar balloon, with apparatus for propelling and mode of managing the same under various circumstances, and show the comparative safety to which this mode of travelling may be reduced.

A balloon 500 feet long and 50 in diameter, gradually tapering from the centre to a point at each end, (which figure, for want of a better name is called a *pointed spheroid*,) is made of strong sheeting, and is rendered tight by oil or varnish; and its form is supported by eight wooden rods, an inch and half in diameter, which extend the whole length of the balloon, inside of the sheeting, and are fastened together at the ends, but separate so as to be equidistant from each other towards the centre, the sheeting being nailed to the rods at every foot of their length, by which they are effectually kept in place. These rods, it will be understood, continue in contact the whole length, until the balloon is inflated, when they become separated as above mentioned.

A stage fifty feet in length and twenty in breadth, constructed economically with regard to the weight of materials, is suspended by cords about twenty feet below the balloon; the cords, thirty or more in number, being attached to the stage at various points and convenient distances, are supported at the top by rings, which are attached by screws to the several rods or ribs of the balloon. The stage is further supported by four other cords, two of which extend from the two forward corners of the stage to the forward point of the balloon, and the other two from the two hind corners to the stern point. To this point is connected, by a universal joint, the end of a pole four inches in diameter, which extends backward horizontally twenty-five feet, tapering to the diameter of two inches. From the small end of this pole four arms project in opposite directions; and from the outward end of each arm, a cord extends to the forward end of the pole, being made fast to both. These arms are six feet long, ten inches wide, and one inch thick, being tennoned to the pole, and supported by a wire which compasses the four, and is fastened to the end of each. To the space between each cord and the pole, a piece of painted cloth is fitted, one edge of which is nailed to the pole, and the other is sewed to the cord: the wide end is also nailed to the arm. Other four arms, six feet in length, project in opposite directions, two vertically and two horizontally, from the forward end of the pole, near the universal joint. Two cords extend from the small end of the pole to the ends of the two horizontal arms last mentioned; thence forward to two pulleys, which are attached to the sides of the balloon, a little forward of the centre; thence down to a light steering wheel, on the forward part of the stage. Three other cords proceed from the same point: two of which pass over the head of the upper arms; thence over two pullies near the first; and the other cord passes to the end of the lower arm, thence over a pulley attached to the lower side of the balloon; and the three terminate on a small shaft, with a crank, ratchet and fall, near the steering wheel, that the steersman may be able to govern the vertical as well as horizontal variations in the direction of the balloon.

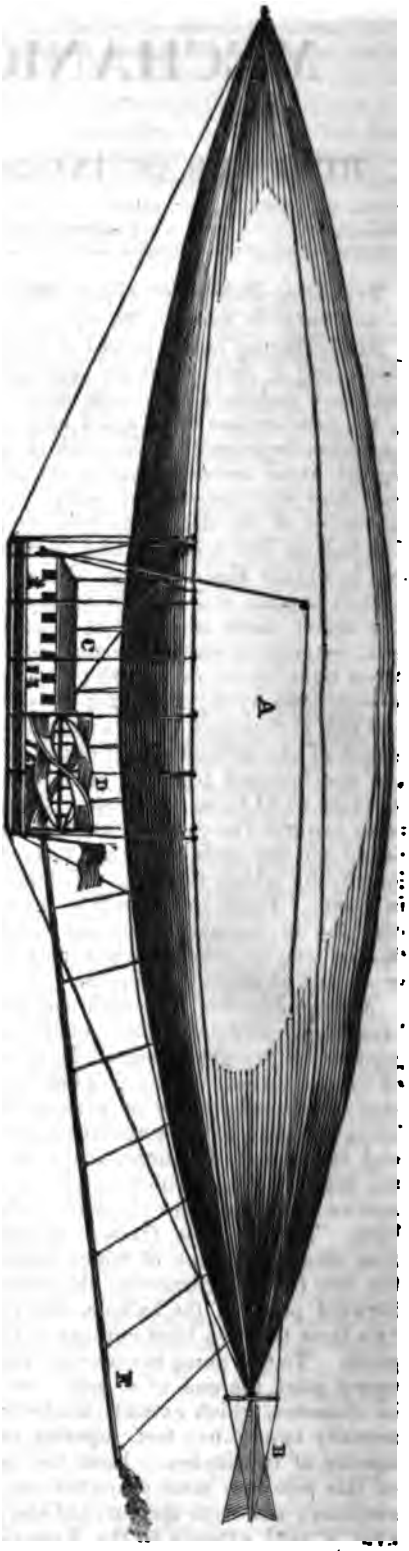
The stage is enclosed by a railing of cordage and net-work, and on the forward and central part is a cabin thirty feet long and ten wide, covered with painted cloth, and supported by the suspending cords. Two spars, thirty-five feet long, and secured in a horizontal position, twenty feet apart, parallel to each other, and about ten feet above the stage, one of them being over the hinder part of the stage, and the other over the end of the cabin. These spars are also supported principally by the suspending cords and braces, and each end of each spar supports the pivot of a revolving shaft, which is twenty feet long, and extends from one spar to the other. Neither the spars or shafts are more than four inches in diameter, but are thoroughly supported by braces of cordage extending from end to end of

each, and passing over circular bearings near the centres. Near each end of each shaft are four arms seven feet long, and other four arms also project from the shaft at every two feet of its length, the several sets of arms not being parallel, but each set varying in direction twenty degrees; thus each row of arms has a spiral direction, extending half round the shaft, and supports a spiral fan of fine oiled cloth, four feet wide, and extending the length of the shaft. The spiral direction of the fans on the two shafts is opposite, being such that the outward motion of the upper fans will mutually tend to propel the machine forward by the re-action of the air. On one end of each shaft is a small spur wheel, or band wheel, by means of which motion is communicated to the spiral fans, from a steam engine of ten horse power, having a boiler of a light portable kind, and situated on the after part of the stage. The engine and connecting machinery need not be particularly described. No other fuel than charcoal is used, and the combustion depends on a blast rather than draught; and the smoke is conducted by a very small and light copper pipe, horizontally to a point a little below the rudder. This pipe is sustained by wires, and as the wind will be invariably ahead, will effectually prevent any danger from the sparks.

The area of the circumference of the balloon is about two thousand feet, and the length being equal to ten times its diameter, it may be propelled fifty miles an hour, by the power that would be requisite to propel a cylinder of the same diameter five miles in the same time, being a uniform pressure of about one ounce to a square foot, or one hundred and twenty-five pounds to the whole area—less than the power of one horse. Hence I infer that the ten horse power engine will be sufficient to propel this balloon at least fifty miles an hour, or stem the current of a heavy gale of wind.

The buoyancy of the balloon is	34,000 lbs.
I estimate the weight of the sheeting, varnished, (4000 yds.,) at	4,000 do.
The wooden rods used in the construction	1,500 do.
Stage, cabin, fan-wheels, and cordage, ...	5,000 do.
Engine, boiler, water, and fuel,	4,000 do.
	14,500
Balance of buoyancy . .	19,500 lbs.

sufficient to carry one hundred passengers, with baggage and provisions. I am aware that no estimate approaching to accuracy can be made of the expense of constructing such a balloon, but it is readily ascer-



Explanation.—A, the body of the balloon; B, helm, or rudder; C, cabin; D, spiral fan-wheel; E, funnel, or smoke pipe.

tained that the expense of the materials (exclusive of the steam engine) would be less than three thousand dollars. A suitable engine would cost two thousand. If then we allow five thousand for preparing, constructing, arranging, and adjusting the several parts, and the expense of inflation, the amount (10,000) is less than the cost of an ordinary ferry boat.

With regard to management, the balloon is to be kept continually inflated, (except in winter,) having on board apparatus for the production of hydrogen gas, and a pipe for conveying the same to the interior of the balloon whenever occasion requires. It is not to be brought to the ground in any case, but moored, when not in use, with a reasonable length of halser, furnished with a self-adjusting pulley. When passengers are to be received or landed, the balloon is brought near the ground, and the passengers are drawn up or let down by a small car, or circular settee. Each passenger is furnished with a parachute, by which each may safely land in case of extreme disasters. This will render their situation less critical than that of those who are exposed to the perils of a raging sea in a leaking ship. Moreover, the stage is furnished with several light hollow cylinders, or sacks of air, of sufficient buoyancy to support the stage with the passengers, should it chance to descend upon the water.

It is obvious, that when passengers are received, a corresponding weight of ballast must be discharged, and vice versa: yet the balloon will admit of a degree of contraction or expansion, by means of cords, sufficient to counterbalance the consumption of fuel and water.

Such is my plan for flying; and as the immortal Fulton ventured to build a steamboat seventy years after Jonathan Hulls had published his plan for the same, I shall indulge the hope that some enterprising person will within another seventy years build and put in successful operation a manageable balloon. And as Fulton experienced some difficulties in securing the patent, on account of the want of originality, I have no hesitation to offer, and promise, at least, an undivided half of my claim to the patent, to any person or company who will be at the expense of building such a balloon on a scale sufficient to test its utility.

Respectfully yours,

RUFUS PORTER.

Billerica, Mass., Sept. 23, 1834.

N. B.—The balloon represented in the plate is 250 feet in length, and 50 in diameter: it being inconvenient to make the drawing correspond in proportions with the description.

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 198.]

PERSPECTIVE.

Q. What is perspective?

A. That science by which objects are ranged in picture, according to our visionary faculties.

Q. How is this to be defined?

A. By the several imaginary lines and points arising in objects so presented to our view.

Q. What is the horizontal line?

A. A line supposed to be drawn parallel to the horizon, through the eye of the spectator; or, rather, it is a line which separates the heavens from the earth, and which limits the sight.

Q. What is the point of sight?

A. That which makes the centrical ray on the horizontal line; or it is the point where all the other visual rays unite.

Q. What are the points of distance?

A. They are points set off in the horizontal line, at equal distances on each side of the point of sight.

Q. What is the base line, or fundamental line?

A. That upon which the picture is seated.

Q. What is the abridgment?

A. Lines which intersect squares.

Q. What are diagonal lines?

A. The lines which run to the points of distance.

Q. What are accidental points?

A. Those points where the objects end; these may be cast negligently, because neither are drawn to the point of sight, nor to those of distance, but meeting each other in the horizontal line. The accidental points serve likewise for casements, doors, windows, tables, chairs, &c.

Q. What is the point of direct view, or of the front?

A. It is when we have the object directly before us; in which case it shows only the fore side—and, if below the horizon, a little of the top; but nothing of the sides, unless the object be polygonous.

Q. What is the point of oblique view?

A. It is when we see an object aside of us, and, as it were, aslant, or with the corner of our eye; the eye, however, being all the while opposite to the point of sight, in which case we see the object laterally, and it presents to us two sides or faces. The practice is the same in the side points as in

the front points—a point of sight, points of distance, &c. being laid down in the one as well as the other.

Q. What does projection delineate?

A. Objects in *plano*, by means of right lines called rays, supposed to be drawn from every angle of the subject to particular points. When the objects are angular, these rays necessarily form pyramids, having the plane or superfices, whence they proceed, for their basis: but when drawn from or to circular objects, they form a cone.

Q. What is to be comprehended by scenography in perspective?

A. That which shows us how to direct the visual rays to every point or part of the picture.

Q. What is stereography?

A. That which enables us to represent solids on a plane, from geometrical projection: whence their several dimensions, viz. length, breadth, and thickness, may all be represented and correctly understood at sight.

Q. What is an original object?

A. That which becomes the subject of the pictures, and is the parent of the design.

Q. What are original planes or lines?

A. The surfaces of the objects to be drawn; or they are any lines of those surfaces; or they are the surfaces on which those objects stand.

Q. What is perspective plane?

A. The picture itself, which is supposed to be a transparent plane, through which we view the objects represented thereon.

Q. What are vanishing planes?

A. Those points which are marked upon the picture by supposing lines to be drawn from the spectator's eye, parallel to any original lines, and produced until they touch the picture.

Q. What is the ground plane?

A. The surface of the earth, or plane of the horizon, on which the picture is imagined to stand.

Q. What is the ground line?

A. That formed by the intersection of the picture in the ground plane.

Q. What are vanishing points?

A. Those marked down in the picture, by supposing lines to be drawn from the spectator's eye parallel to any original lines, and produced until they touch the picture.

Q. What is the centre of a picture?

A. That point on the perspective plane where a line drawn from the eye perpendicular to the picture would cut it; consequently, it is that part of the picture which is nearest to the eye of the spectator.

Q. What is the distance of the picture?

A. That from the eye to the picture.

Q. What is the distance of a vanishing point?

A. The distance from the eye of the spectator to the point where the converging lines meet; and, after gradually diminishing all the objects which come within their direction and proportion, are reduced so as, in fact, to terminate in nothing.

Q. Do all parallel lines have the same vanishing point?

A. Yes; that is to say, all such as are, in building, parallel to each other, when not represented precisely to and parallel with the eye, will appear to converge towards some finite point, that is, their vanishing point. Circles, when retiring in such manner, are represented by ellipses proportioned to their distances; and their dimensions in perspective are ascertained by enclosing them where a regular succession is to be pourtrayed within a square, which being divided into a number of equal parts or chequers, will exhibit all the proportions of those more remote.

Q. What is a bird's eye view?

A. It is supposed to be taken from some elevated spot, which commands a prospect nearly resembling the plane or ichnography of the places seen. Thus, the view from a high tower, or from a mountain, (whence the altitudes of the various objects on the plane below appear much diminished,) gives nearly the same representation as offered to a bird flying over them: and hence the term. Some idea of this may be obtained by standing on any height, and observing how low those objects, which are near thereto, will appear when compared with those more distant—taking, however, the perspective diminution of the latter into consideration.

Q. What is to be observed when a picture is to be placed on high?

A. The point of sight should be assumed low, and *vice versa*, in order that the horizontal line of the picture may be as near as possible in the same horizontal plane with that of the spectator, for this disposition has a surprising effect. The point of sight being fixed according to the situation in which the picture is to be placed, the point of distance is next to be determined. In doing this, three things are to be noticed: 1st, that the spectator may be able to take in, at one glance, the whole and every part of the composition; 2d, that he may see it distinctly; 3d, that the degradation of the figures and other objects of the picture be sufficiently sensible.

Q. What are the general rules to be observed?

A. 1. Let every line, which in the object or geometrical figure is straight, perpendicular, or parallel to its base, be so also in its scenographic delineations, or in the descriptions, in all its dimensions, such as it appears to the eye; and let the lines, which in the object return at right angles from the fore right side, be drawn in like manner scenographically from the point of sight.

2. Let all straight lines, which, in the object, return from the fore right side, run in a scenographic figure into the horizontal line.

3. Let the object you intend to delineate, standing on the right hand, be placed also on the right hand of the point of sight; that on the left hand, on that hand of the same point; and that which is just before, in the middle of it.

4. Let those lines, which in the object are equidistant from the returning line, be drawn in the scenographic figure from the point found in the horizon.

5. In setting off the altitudes of columns, pedestals, &c. measure the height from the base line upward, in the front or fore right side; and a visual ray down that point, in the front, shall limit the altitude of the column or pillar, all the way behind the front side or orthographic appearance, even to the point of sight. This rule must be observed in all figures, as well where there is a front or fore right side as where there is none.

6. In delineating ovals, circles, arches, crosses, spirals, and cross arches, or any other figure in the roof of a room, first draw ichnographically, and so, with perpendiculars from the principal points thereof, carry it up to the ceiling, from which several points carry on the figure.

7. The centre in any scenographic regular figure is found by drawing cross lines from the opposite angles, for the point where the diagonals cross is the centre.

8. A ground plane of squares is alike, both above and below the horizontal line; only, the more it is distant, either above or below the horizon, the squares will be so much the larger or wider.

9. In drawing a perspective figure, where many lines come together to direct your eye, draw the diagonals in red, the visual lines in black, the perpendiculars in green, or any other color different from that which you intend the figure shall be.

10. Having considered the height, distance, and position of the figure, and drawn it accordingly with its side or angle against the base, raise perpendiculars from the several angles, or designed from the figure to the base, and transfer the length of each perpendicular from the place where it touches the base to the base on the side opposite to the point of distance. Thus the diametrals to the perpendiculars in the base, by intersection with the diagonals drawn to the several transferred distances, will give the angles of the figures; and so lines drawn from one point to another will circumscribe the scenographic figure.

11. If in a landscape there be any standing waters, (as lakes, ponds, &c.) place the horizontal line level with the farthest sight or appearance of it.

12. If there be houses, churches, &c. in the landscape, consider their position, that you may find from what point in the horizontal lines to draw the front and sides of them in the picture.

13. In drawing objects at a great distance, observe the proportions, both in magnitude and distance, in the draught, which appear from the object to the eye.

14. In coloring and shadowing near objects, you must make the same colors and shades in your picture which you observe with your eye in the landscape; but according as the distance becomes greater, the colors must be fainter, till at last they are gradually lost in a darkish sky color.

Q. What is aerial perspective?

A. It is the art of giving a due diminution or degradation to the strength of the light, shade, and colors of objects, according to their different distances, the quantity of light which falls on them, and the medium through which they are seen.

As the eye does not judge of the distance of objects entirely by their apparent size, but also by their strength of color, and distinction of parts, so it is not sufficient to give an object its due apparent bulk according to the rules of stereography, unless at the same time it be expressed with the proper faintness and degradation of color which the distance requires. Thus, if the figure of a man at a distance were painted of a proper magnitude for the place, but with too great a distinction of parts, or too strong colors, it would appear to stand forward, and seem proportionally less, so as to represent a dwarf situated near the eye, and out of the plane on which the painter intended for it to stand. By the original color of an object, is meant that color which it exhibits to the eye, when duly exposed to it in a full, open, uniform light, at such a moderate distance as to be clearly and distinctly seen.

The color receives an alteration from many causes, the principal of which are the following:

1. From the objects being removed to a greater distance from the eye, whereby the

rays of light which it reflects are less vivid, and the color becomes more diluted, and tinged in some measure by the faint bluish cast, or with the dimness or haziness of the body of air through which the rays pass.

2. From the greater or less degree of light with which the object is enlightened—the same original color having a different appearance in the shade from what it has in the light, although at an equal distance from the eye; and so in proportion to the strength of the light or shade.

3. From the color of the light itself, which falls upon it, whether it be from the reflection of colored light from any adjacent object, or by its passage through a colored medium, which will exhibit a color compounded of the original color of the object and the other accidental colors which the light brings with it.

4. From the position of the surface of the objects, or of its several parts with respect to the eye, such parts of it appearing more lively and distinct than those which are seen obliquely.

5. From the closeness or openness of the space where the object is situated, and light being much more variously directed and reflected within a room than in the open air.

6. Some original colors naturally reflect light in a greater proportion than others, though equally exposed to the same degrees of it; whereby their degradation at several distances will be different from that of other colors which reflect less light.

Animal Mechanics, or Proofs of Design in the Animal Frame. Part II., showing the Application of the Living Forces. [From the Library of Useful Knowledge.]

(Continued from page 232.)

Of the Changes in the Material of the Animal Body during Life.—We have seen the motions performed in the animal body through the actions of the muscles and the play of the mechanical parts, and we have had occasion to reflect on the action of the heart, and the motion of the blood in the circulation; but these are as nothing, compared with the interest of our present subject—the changes going forward in the solid material of the frame. It is not surprising that the individual who retains every peculiarity of body and of mind, whose features, whose gait, and mode of action, whose voice, gestures, and complexion, we are ready to attest as the very proof of personality, should in the course of a few days change every particle of his solid fabric?—that he whom we suppose we saw, is, as far as his body is concerned, a perfectly different person from him we now see? That the fluids may change we are ready to allow, but that the solids are thus ever shifting seems at first improbable. And yet, if there be any thing firmly established in physiology, if there be truth in the science at all, this fact is incontrovertible.

There is nothing like this in inanimate nature. It is beautiful to see the shooting of a crystal—to note, first, the formation of integrant particles from their elements in solution, and these, assuming a regular form under the influence of attraction or crystalline polarity, producing a determinate shape; but the form is permanent. In the different processes of elective attraction, and in fermentation, we perceive a commotion, but in a little time the products are formed, and the particles are at rest. There is in these instances nothing like the revolutions of the living animal substance, where the material is alternately arranged and decomposed. The end of this is that the machinery of the body is ever new, and possesses a property within itself of mending that which was broken, of throwing off that which was useless, and of building up that which was insecure and weak; of repelling disease, or of controlling it, and substituting what is healthful for that which is morbid. The whole animal machinery we have seen to be a thing fragile and exposed to injury; without this continual change of material, and this new modelling of that material, our lives would be more precarious; the texture of our bodies would be spoiled like some fine piece of mechanism which had stopped, and no workman would have science sufficient to reconstruct it. But by this process the minute particles of the body die successively; not as in the final death of the whole body, but part by part is deprived of its vitality, and taken away into the general circulation, whilst new parts are endowed with the property of life, and are built up in their place. By this revolution, we see nature, instead of having to establish a new mode of action for every casualty, heals all wounds, unites all broken bones, throws off all morbid parts by the continuance of its usual operations; and the surgeon, who is modest in his calling, has nothing to do but to watch, lest ignorance or prejudice interfere with the process of nature. This property of the living body to restore itself when deranged, or to heal itself when broken or torn, is an action which so frequently assumes the appearance of reason, as if it were adapting itself to the particular occasion, that even the last great luminary in the science, Mr. John Hunter,

speaks of parts of the body as "conscious of their imperfection," and "acting from the stimulus of necessity," thus giving the properties of mind to the body as the only explanation of phenomena so wonderful.

We make a moderate assumption, when we declare these changes to be under the guidance of the living principle. In a seed, or a nut, or an egg, we know that there is life, and from the length of time that these bodies will remain without change, we are forced to acknowledge that this life is stationary or dormant, and limited to the counteraction of putrefaction, or chemical decomposition; but no sooner does this principle become active, than a series of intestinal or internal changes are commenced, which are regularly progressive, without a moment's interruption, while life continues.

That principle, which may continue an indefinite number of days, months, or years, producing no change in all this time, begins at once to exhibit its influence, builds up the individual body, regulates the actions of secretion and absorption; and by its operation upon the material of the frame, stamps it with external marks of infancy, maturity, and age.

But let us examine the proofs of this universal change in the material of the body. It is not very long since a bone was supposed to be a concrete juice, and that the liquid parts were converted into solids, as we see mortar or Paris plaster from fluid assuming a solid form. But the anatomist began to observe that the bones were porous; that these pores admitted membranes and vessels; and some went so far before their brethren, as to assert that they saw arteries, veins, lymphatics, and nerves, going into the bone; in short, the opinion gradually grew stronger, that they were living parts, and subject to all the changes to which the softer parts of the living body were liable. An accident gave admirable proof of this. It was found that the bones of pigs, fed with the refuse of the dyer's vats, in which madder was contained, became tinged of a beautiful red color. It was this fact which ingenious physiologists made use of, and which enabled them to demonstrate the rapidity with which the old bone was carried away, and new bone substituted. The physiologist observed, that if he threw a bone into the fire, what is called the animal part was burned and dissipated, but there remained, imperishable by this process, a mass of earth, which proved to be the phosphate of lime. He thought of varying his experiment, and put the bone into acid, which dissolved that phosphate of lime, and left the bone to all outward appearance as before. It had its form, its membranes, its vessels, but when pressed it proved to be soft and pliant; the phosphate of lime having been dissolved and extracted, it was no longer capable of the office of a bone, to bear the weight and motions of the body. When the experiments with madder were resumed, it appeared that when this earth of bone was about to be secreted from the circulating vessels, and deposited in the membranes of the bone, it met with the coloring particles of the madder in the blood; and, as the chemist would explain, the madder and the phosphate of lime were precipitated, and filled all the interstices of the membranes and vessels. We shall not stop here to inquire into the admirable manner in which this hardening material of bone is deposited for the purposes of strength; it is only the change upon the material which we have now to contemplate.

If this earth of bone so colored had been deposited for a permanency, and built into these cells and crevices, like brick and mortar, the color would remain; but, however deeply the bones of an animal may be tinged in this manner, the color is not permanent, unless the animal continues to be fed with the madder. If its food be pure of the madder, even for a few weeks, and if after this the animal be killed, its bones are white, that is to say, the old particles of phosphate of lime are carried away by absorption, and with them the coloring material; and that newer bone which is deposited by the arteries is untinged and pure, having no coloring material to attract.

It is unnecessary to follow out those curious experiments by which the physiologist has shown the rapidity of the formation of a new bone around the broken end of an old one, and the deep tinge such new bone takes, compared with the fainter color of that which had been perfect, previous to the feeding with madder; the manner in which, by feeding the animal alternately with madder and without it, he contrives to exhibit different colored layers in the growing bone. It is sufficient for our purpose to know, that the densest part of the animal frame is subject to change, like the most delicate texture of the body, and that the only means of arresting the motion is to deprive it of life; if a part of a bone be killed by the application of a cautery, that moment it becomes permanent, and is subject to no change, whilst all the parts around it are undergoing their revolutions.

The bones of the legs and thighs, which suffer the fatigue of motion, and which support the weight of the body, without dimin-

ishing in their length, or altering in the slightest measurable degree their proper form, are nevertheless undergoing an operation of repair, in which the old particles are withdrawn, whilst new ones replace them. We see with what care the walls of a house are shored up to admit of repair—how carefully the workman must estimate the strength of his pillars and beams—how nicely he must hammer in his wedges, that every interstice may be filled, and no strain permitted; and if this operation fail in the slightest degree, it is attended with a rent of the wall from top to bottom. We say, then, that by the very awkwardness of this process, in which, after all, there is danger of the whole fabric tumbling about the workmen, we are called upon to admire how the solid pillars in our own frame are a thousand times renewed, whilst the plan of the original fabric is followed to the utmost nicety in their restoration. And if it deviate at all, it is only in a manner the more to surprise us, since on examination it will be discovered to result from an adaptation of the strength of material to some new circumstance, the increasing weight it has to support, or the jar that it is subject to from the change in the activity or exercise of the body.

There is a disease of the bone which illustrates this in a surprising manner, and proves to us, that however diseased and monstrous in its shape the bone may be, yet there is a natural law operating, which by its prevalence will overcome the morbid action, and from a shapeless mass restore the bone to its natural condition.

This disease is called *necrosis*, which word signifies the *death* of the bone merely; but it is death in very peculiar circumstances; a new bone is formed around the old one; a large and clumsy cylinder is fashioned of the earth of bone, in the hollow of which the shaft of the old bone is contained. After a long time the old bone comes out through this new case, and, with the aid of the surgeon, it is altogether withdrawn from the limb. During all this process the patient is capable of supporting his weight upon that limb, so that it resembles on a large scale that change which we have described as going continually on in the molecules of the bone; a new part is substituted, and the old taken away.

If workmen were to take away a pillar in the following manner, their work would resemble the process of necrosis: first, they must rear a hollow cylinder around the old pillar, resting on the plinth and base, and extending to the capital, and having secured the union of the cylinder at top and bottom to the extremities of the pillar, they must take away the shaft, or middle piece of the old pillar, by perforating the new cylinder.

The reader may easily imagine that when this process is completed in a man's limb, it will be as clumsy as the leg of an elephant, large, firm, and shapeless; but the extraordinary circumstance is still to be described. This new bone is gradually diminished in its exterior surface, and its hollow filled up, and thus by a change scarcely perceptible it resumes the form and dimensions of the original bone; and, after a time, the anatomist might examine this limb, and find, neither in the articulating surfaces, nor in the spines and ridges, nor in the points of attachment for ligaments and muscles, any thing to indicate the extraordinary revolution that had taken place.

What explanation have we to give of this change? There can be no doubt that the material is not the same; for we have the old bone in our hand, and the man is walking upon a new bone. Yet extraordinary, then, as this appears, it is not more inexplicable than the common phenomenon of the growth of an infant to maturity. There is a living principle which is permanent while the material changes; and this principle attracts and arranges, dissolves and throws off successive portions of the solids. There is a law influencing this living principle, which, in its operation on the material, shapes and limits the growth of every part, and carries it through a regular series of changes, in which its form and aptness for its office are preserved, whilst the material alone is altered.

The influence of disease will for a time disorder this modelling process, and produce tumors and distortions; but when at length the healthy action, that is the natural action, prevails, these incumbrances are carried away, and the fair proportions of the fabric are restored.

It is very pleasing to observe the different means employed where a slight change of circumstances demands it. This earth of bone—the phosphate of lime—is changing continually, but the teeth admit of no change; they consist of earth too—the phosphate, carbonate, and fluate of lime. Bodies calculated for such violent attrition, and with a surface so hard as to strike fire with steel, would be ill accommodated with such a property of changing as we have seen in the bones. They must therefore fall out, and be succeeded by new ones; and this process, familiar as it may be, is very curious when philosophically considered.

There are no teeth whilst yet the infant

is at the breast; and when they rise they are attended with new appetites, and a necessity for change of food. When perfected, they form a range of teeth, neat and small, adapted to the child's jaws and the size of its bones. Were they to grow at once, or to fall out at once, it would prove a disturbance to the act of eating. They fall in succession; their fangs are absorbed, they are loose and jangling, and are easily extracted. But now comes the question, why are these teeth of the infant old at six years? Why are those that are to succeed, and be stationary for a series of years, to germinate and grow at the appointed time, like the buds in the axilla of a leaf? And when fully formed, why do they remain perfect for sixty years instead of six, at the end of which term the first set were old and decayed? No difference can be observed in the material of the teeth of the first or second set. The one will be as perfect as the other after remaining a hundred years in a charnel house. Can any one refuse his belief, then, when he sees so accurate a mechanical adaptation of the teeth to their places and their offices; can he, we say, refuse assent to this also, that there is a law impressed, a property by which the milk teeth shall fail and be discharged from the jaw in six years, whilst the others will last the natural life of the adult, if not injured by accidents, to which all parts are subject? This is not the only instance in which parts of the body lie dormant for a term of years, and are at a particular period of life developed and perfected —and which have, we may say, their time of infancy, perfection, and decay, whilst yet there is no material deterioration observable in the general frame.

We are thus brought to the consideration of a question which has not yet been fairly stated.

Those who say that life results from structure, and that the material is the ruling part, bid us look to the contrast of youth and age. The activity of limb and buoyancy of spirit they consider as a necessary consequence of the newness and perfection of organization in youth. On the other hand, a ruined tower, unroofed, and exposed to be broken up by alternation of frost and heat, dryness and moisture, wedged by the roots of ivy, and tottering to its fall, they compare with old age—with the shrunk limbs, tottering gait, shrivelled face, and scattered grey hair of the old.

But in all this there is not a word of truth. Whilst there is life and circulation there is change of the material of the frame, (and there is a sign of this if a broken bone unites, or a wound heals.) Ascribe the distinction to the rapidity of change, to the velocity of circulation, or to the more or less energy of action; but with the antiquity of the material it can have nothing to do. The roundness and fullness of flesh, the smoothness, transparency, and color of the cheek, belong to youth, as characteristic of the time of life, not as a necessary quality of the material! Is there a physiognomy in all nature—among birds, and beasts, and insects, and flowers—and shall man alone have no indication of his condition in the outward form and character?

The distinctions in the body, apparent in the stages of life, have a deeper source than the accidental effects of the deterioration of the material of the frame. The same changes which are wrought on the structure of the body in youth, and in the spring of life, are going on in the last term of life; but the fabric is rebuilt on a different plan. The law of the formation is still inherent in the life which has hurried the material of the body through a succession of changes; and each stage, from the embryo to the fœtus, the fœtus to the child, from that to adolescence, to maturity, and to the condition of old age, has its outward form, as indicative of internal qualities, but not of the perfection or imperfection of the gross material. We might as well consider the difference in the term of life of the annual or biennial plant, as compared with the oak, or the ephemeris fly as compared with the bird that hawks at it, to be in the qualities of the matter which forms them, as that the outward characters of the different stages of human life arose from the perfection or imperfection of the material of the body. Not only has every creature its appointed term of life, but we have shown that parts of the human body do not, in this respect, bear a relation to the whole: organs are changed and disappear; others, in the mean time, at their regulated period, shoot to perfection, and again decay before the failure of the body. What can more distinctly show that it is the principle of life that directs all; and that on it the law is imprinted which orders our formation, and all the revolutions we undergo. The material of the body, solid and fluid, is moved by this influence, and varies every day, part by part dying every hour, and renewed, until the series of its changes on the gross material of the body is accomplished in an entire and final separation.

The grand phenomena of nature make powerful impression on our imagination, and we acknowledge them to be under the guidance of Providence; but it is more pleas-

ing, more agreeable to our self-importance, it gives us more confidence in that Providence, to discover that the minutest changes in nature are equally His care, and that "all things do homage."

Although it be true that every thing in nature, being philosophically contemplated, will lead to the same conclusions, yet the occurrences around us steal so imperceptibly on our observation, all the objects of nature, or at least vegetable and animal productions, grow up by so slow a process by our side, that we do not consider them at all in the same way as we should do if they started suddenly upon our vision.

It is this familiarity with the qualities of a living body, and a habit of seeing without reflection, which has made it necessary to carry the reader through so long a course of observation and reasoning to excite attention to the admirable structure of his own frame, and its adaptation to the earth we inhabit—to perceive that every thing is formed with a strict relation to the human faculties and organs, to extend our dominion, and to multiply our sources of enjoyment. It is by seeing the plan of Providence in the establishment of relations between the condition of our being and the material world, that we learn to comprehend that unity of design in the creation in which we form so great a part.

This exaltation of our nature is not like the influence of pride or common ambition. We may use the words of Socrates to his scholar, who saw in the contemplation of nature only a proof of his own insignificance, and concluded "that the gods had no need of him," which drew this answer from the sage: "The greater the munificence they have shown in the care of thee, so much the more honor and service thou owest them!"

The Dry Rot.

H. Niles, Esq.:

Dear Sir,—I send you herewith a copy of a communication that I caused to be placed in the Navy Department at Washington last winter, which I wish you to publish in your useful Register for the benefit of those who may see proper to make use of it, and oblige, dear sir, your obedient servant,

Wm. Patterson.

Baltimore, Oct. 18, 1834.

Dry Rot.—The dry rot in ships of war and merchant vessels has long been a subject of serious and anxious concern. Many plans for their preservation from this evil have been suggested and tried without success. Having, for a long series of years, had considerable experience as a constructor, owner, and employer of merchant vessels, and believing that I have succeeded, at least I have succeeded to my own satisfaction, in preserving ships of this description as long as they are likely to be useful or profitable—I therefore feel prompted to unfold my plans and my experience to the Navy Department.

In order that those plans and that experience may be better understood, I shall commence with my situation and observations in early life.

In the year 1766, at a very early age, I was placed in the counting-house of a shipping merchant in Philadelphia, which city was, at that time, celebrated, perhaps beyond any other place in America, for fine vessels. My employers were largely engaged in the shipping business—they built a ship or vessel every year or two; here I had a favorable opportunity of seeing and becoming familiar with the building, equipage and employing of merchant sea-vessels. Owing to these circumstances, I acquired so great an attachment and fondness for vessels that they have adhered to me through a long life. Then, as now, the speedy decay of ships was a matter of serious consideration, and every scheme for their preservation that was suggested was tried, but without answering any useful purpose. Some merchants, in building vessels, allowed their frames, when raised, to remain for a length of time on the stocks, exposed to the weather; others smeared the timbers with fish oil; and others again used oil and paint; all of these experiments were attended with little or no success. In one instance, I know the frame of a vessel to be plied with fish oil throughout an entire summer; and, in the fall of the year, when she was about to be finished, it was discovered that the oil had penetrated the timbers more than a quarter or half of an inch; this proved to be little or no protection, and the experiment was abandoned. In another instance, I knew of a very fine vessel built, (for a Charleston packet,) with so much care that she required no caulking nor repairs for four years; at the end of that time, when she was carried into dock to be caulked, she was found to be so totally destroyed by the dry rot as to be unworthy of repair, and was broken up. Her rapid decay was attributed to the unusual care which had been taken of her whilst running.

Some few, even at that early period, made use of salt; but a great prejudice existed against this mode, owing to the belief that it corroded the iron fastenings, (copper was

not then used in fastening our vessels,) and the apprehension that the dampness in a salted vessel might be injurious to the cargo.

I became a ship owner in the year 1773, and one of my first considerations was, how should I preserve that description of property from speedy decay? Observing that timber, when sunk deep in swamps or in the water, lasted for ages, I concluded that exclusion from the air, and saturating the pores of the wood with moisture, must be the true secret for its preservation. Reflecting on this circumstance, and perceiving that the wooden floors of ware-houses used for the storage of Bay salt were always damp in moist weather, I was led to the conclusion that Bay salt, properly applied, must have the effect of preserving timber. Under this impression, I adopted the following plan with all the vessels I have built from that time till the present, (a period of more than sixty years, as I am still a ship owner;) while building, when the bends and bottom planks are on, and before delling, I have caused three sets of stoppers to be placed fore and aft between all the timbers, to keep the salt in its place. The first tier of stoppers are placed at the floor heads, the second immediately below the lower deck beams, and the third between decks, just above the air streak, common in all double decked vessels. Air streaks are left above the first and second tiers of stoppers for the purpose of adding more salt as the previous supplies of that article settle or are dissolved. Just before finishing the ceiling of the vessel, the salt is filled in among all of the timbers from the lowest tier of stoppers to the upper deck—taking care that the salt in the upper tier is well rammed down, (if wetted, so much the better,) for, after the plank-shears are laid, and secured in their places, the salt cannot be re-placed without incurring too much trouble and expense.

Having experienced great difficulty in preserving large timbers, (especially transoms,) above light water mark, I have of late years had such pieces bored through the centre with an auger of two inches or two inches and a half in diameter. These holes are filled with wetted salt, and then plugged at both ends before placing the timbers in the vessel.

In the forward and after parts of the vessel, where the timbers are so close together that salt cannot be introduced among them, I have found it necessary to incase the timber, and confine the salt in this way. In one instance I had all of the knees, and the steps of the masts, in a fine ship, boxed in and filled with salt; this answered a very good purpose, but it is too troublesome in merchant vessels.

I have not only sailed my vessels in the manner pointed out above, in the first instance, but I have had them examined carefully every two or three years, and where the salt has wasted or settled, a fresh supply has been added.

In all my experience I have never found a defective timber in vessels thus prepared, and thus taken care of, and I am persuaded that the dry rot may be entirely prevented by adopting the above precautions. As a proof of the good effects of the above mode, I will add, that I have two vessels now running, which are perfectly sound and trustworthy; one of them is 31 years old, and the other 25; and the only repairs that have been given to their hulls were the renewal of the waist planks of both, and the quarter deck of one of them. This was not owing to the decay of the plank, but to the circumstance of its being fastened with iron. The corrosion of the iron caused openings where it passed through the wood: had copper fastenings been used, the decays would not have happened. I think all vessels of war ought to be secured with copper fastenings, and no iron ought to be used when it can possibly be avoided.

I have seldom used the live oak in the construction of vessels, as it is hard to work, and too heavy for merchant ships: I greatly prefer the timber of our bay—white oak, locust, cedar, and yellow pine. I use the white oak for the frames, and for plank from the keel up to and including the bends. From the bends to the upper deck, I form the frame of locust and red cedar, an equal number of pieces of either kind alternately distributed. The sides, quick-work, decks, upper beams, and carlins, are formed of the heart of yellow pine. Latterly I have fastened the sides and decks with copper.

My vessels have generally been employed on long voyages to the East Indies and South America; and to guard against delay and accidents on such voyages, I have fitted them out in the following manner: They are copper fastened—then sheathed with yellow pine boards one inch in thickness, put on with copper nails of two inches or two inches and a half in length; a layer of strong paper dipped in tar is placed between the pine boards and the bottom of the vessel; and another layer of paper, prepared in like manner, is placed between the pine boards and the copper. The copper sheathing that I use weighs from 28 to 32 ounces the square foot. In this way the vessel may be said to have five bottoms—two of wood, two

of paper, and one of copper. They are so tight, that it is necessary to have cocks through which water may be introduced into the hold to keep the vessel sweet. An additional advantage is, that they may be run with safety two or three years longer than they could do if they were coppered on a single bottom of wood.

One of my vessels ran 17 years, and wore out three sets of sheathing copper before I removed the pine boards; fearing that the main bottom might require some attention in consequence of the decay of the oakum, I stripped off the sheathing boards, and discovered to my surprize that the bottom and seams were in perfectly good order—indeed, it appears as if the water had never penetrated to the main bottom, and that the sheathing of wood might have remained on with safety for many years longer.

The year before the breaking out of the late war with Great Britain, I commenced building a fine vessel, and had her frame raised, her bends on, and bottom planked, when I determined to proceed no farther. I erected a shed over the vessel, under which she remained four years before I concluded to finish her. All possible care was taken of her, yet some of the large pieces of timber were found defective, especially the transoms—timbers 18 inches square were found to be entirely destroyed by dry rot, although the interior exhibited no symptoms of unsoundness. It was owing to this circumstance that I resorted to the above cited plan of boring the large timbers and filling the holes with salt.

For the preservation of vessels of war, the method which I have pointed out, and which I have pursued, would be of great consequence: it would save millions annually to those governments which from choice or from necessity keep fleets in commission.

The only difficulty in the way of its introduction arises from the prejudice against the use of salt, under the impression that it causes too great a degree of moisture in the places allotted for the accommodation of the officers and crews. I have experienced no inconvenience in this respect, when the cabins are lined with dry boards, attached to the inner ceiling; nor have I in any instance found that any danger has happened to the cargoes in consequence of the moisture.

To overcome any inconvenience that might be apprehended, it is only necessary to prepare the accommodations for the officers and men, in ships of war, by fastening strips of plank an inch thick, up and down, to the sides of which strips a sheathing of dry boards can be attached. This will effectually prevent the escape of the moisture. The northern and eastern fronts of our country houses are sometimes secured in this manner from north-east storms.

I have mentioned Bay salt as the only kind that ought to be used for the preservation of vessels, owing to its quality of giving in moist weather—dry stoved salt does not possess this quality, and is therefore unsuitable.

I have had some experience with fast sailing vessels, vulgarly called *Baltimore clippers*, and I have witnessed their rise and progress in two wars. Some of them have performed wonders—it is only necessary to say, that they require great care and judgment in their construction and equipment, and that they should be commanded by men trained in their management.

WILLIAM PATTERSON.

Baltimore, Feb. 26, 1834.

RUINS OF ARAXES.—It was in this very ancient city, then in the meridian of its architectural splendor, and the pride of Persia, that Alexander and his Greeks sung, and danced, and revelled. At the present moment, the massive ruins only faintly express its former grandeur and magnificence. Martyn, the missionary, the last visitor whose remarks we have consulted, says, "I saw no appearance of grand design any where. The chapiters of the columns were almost as long as the shafts, though they are not so represented in Niebuhr's plates; and the mean little passages into the square court or room, or whatever else it was, make it very evident that the taste of the Orientals was the same 3000 years ago that it is now." — [Scientific Tracts.]

LOVE OF SCIENCE.—A distinguished English missionary, located in India, has such an ardent love of botany, (though it would seem from the volumes of learned translations he has made, that he had no time for any other employment,) that his garden is enriched with every plant and tree that can be made to grow in India. It is still more remarkable, that he can readily call each one by its appropriate technical name. His house is fitted up with shelves, on which are plants, minerals, shells, and groups of cages filled with living birds.—[Ibid.]

COALFIELD STEMS.—This term is applied to vegetable remains found in coal beds. H. T. M. Witham, Esq. of Edinburgh, is pursuing an interesting series of experiments upon these preserved vegetables, and will feel greatly indebted to gentlemen in

this country, who will forward to his address any such specimens, found either in bituminous or anthracite coal mines of the United States.—[Ibid.]

Description of a Safety Stirrup.—(By Samuel Jackson, M. D., of Northumberland, Penn.)—The business of the practical physician is not merely to prevent or cure diseases, but also to obviate all the casualties to which we are liable in the journey of life; hence, though the present paper may not be quite medical, or pertain, very strictly considered, to the pages of your journal, yet in as much as it recommends a means of safety to your numerous readers, most of whom are country practitioners and riders on horseback, it will not, by them at least, be thought out of place. Were I to present them with an effectual preventive or cure of hydrophobia, how great would be their exultation; and yet what we are now recommending might have prevented more death and distress, in this neighborhood at least, than has ever resulted from rabies canina. Not one case of this disease has been known within a radius of fifty miles from this place, and probably not within a much greater distance, for the last half century, while, within this very vicinity, and within a very few years, the most distressing lacerations, and even death, have been the sad consequences of persons being dragged by the stirrup.

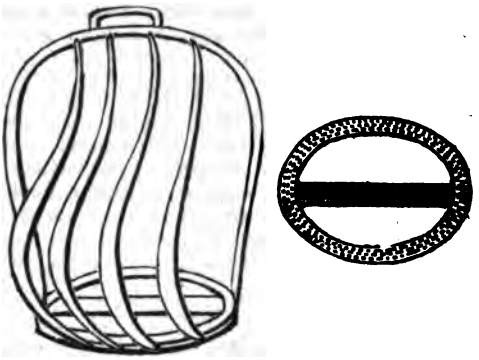
It is generally supposed that the spring stirrup, which opens at the side, affords safety in these cases, and there is an extract from one of my letters in the Medical Recorder, vol. xi., p. 208, in which it is highly recommended as securing the exit of the foot, let the rider fall in whatever way it is possible. But we have since learned from the actual experiment of falling and hanging by the stirrup, *in propria personæ*, that our opinion, so confidently advanced, is utterly erroneous.

After using the stirrup for many years with the most comfortable assurances of safety, I was at last thrown, and my foot was held fast by it, while my head and shoulders rested on the ground. In this dreadful situation, my horse, though young and high-spirited, stood quiet by my side, while with infinite labor and pain I extricated my foot. I was then told that the rust of the hinge was the cause of its refusing to open, but this was a great error, as was proved by the following decisive experiment.

The hinge was well greased and made to work with very slight force: I then extended myself on the carpet with my foot in the stirrup, and giving the leather to my servant, I found it absolutely impossible to open it with my foot. The operations were varied in every way in which it was thought possible for a man to fall from his horse, and with the same result. The foot turns quickly round in falling, and hangs by the foot-piece of the stirrup.

I mentioned these things to my talented friend, Mr. Henry W. Snyder, of Selinsgrove, son of the late Governor of Pennsylvania, and he quickly made me a pattern of a stirrup, which I have since procured to be made by Mr. George Taber, of Philadelphia. It can be easily understood from the plate. Fig. 1, the entire stirrup. Fig. 2, the foot-piece.

Fig. 1. Fig. 2.



For an adult, three of the upright or safety irons are sufficient, but as the stirrup may be used by very young persons with small feet, they ought to be very close, and five would be required. These safety bars may be an inch broad. In order to afford him foot-hold, the foot-piece ought to be broad, and the opening in it guarded by a bar in the transverse diameter, as seen in the plate.

We cannot recommend this as a very handsome part of a horseman's caparison, but it is certainly not very unsightly; and until something better be invented, we beg leave to obtrude it upon the attention of all who would ride without fear of the deplorable consequences of being dragged by the common stirrup. Nearly all the evils attendant on human life are the immediate or remote consequences of neglecting either the moral or physical laws, by which our safety is ensured; and if any one reads this paper without availing himself of this cheap and easily procurable prophylactic, let us refer him for further instruction to one of the best books that ever saw the light—Combe "On the Constitution of Man." "We ought," says this author, "to trace the evil back to its cause, which will uniformly resolve itself into infringement of a natural or moral law; and then endeavor to discover whether this infringement could or could not have been prevented by a due exercise of the physical and mental powers bestowed by the Creator on man."—[American Journal of the Med. Sciences, Nov. 1833.]

Abstract of the Proceedings of the New-York Lyceum of Natural History.—The proceedings of this scientific association should be more familiar to the public. We hope to give, in future numbers of the Magazine, a popular sketch of the transactions, and, with this view, commence with the following, from the Journal of Science.

It may be proper here to state, that although, owing to circumstances which have threatened

the existence of the society, the Lyceum has not published its annals since 1828, nor any abstract of its proceedings since 1830, its members have by no means relaxed from their former exertions for the promotion of Natural History. The library and collections of the various departments have been greatly augmented, as will be seen by the following abstracts. The collection of minerals, from private donations, and especially that of the valuable cabinet of the late Dr. Mitchill, and from the replacement of inferior by more perfect specimens, has been very greatly augmented and improved. Ample matter has been collected for the future numbers of the Annals, one of which, it is hoped, will soon appear. We may indeed affirm, that the Lyceum was never in a more flourishing condition than at the present time. The rooms, situated at the corner of White and Centre streets, are open daily from 12 o'clock until sun-set, where the librarian and keeper will be present to welcome all visitors who are interested in the promotion of natural history.

ABSTRACT FOR 1831.

January.—Dr. Dekay read a paper, entitled "Examination of the facts and arguments by which it is attempted to be proved that lava has not been subjected to great elevations of temperature." In this memoir, the author, avoiding any decided hypothesis, confines himself to the examination of the heat of volcanic lava, and endeavors to show that the arguments by which the doctrine of low temperature had been defended were opposed by numerous facts; at the same time, he explains on different principles the few facts by which the idea of low temperature appears to be supported.

Dr. Dekay read a paper on the propriety of preparing a Natural History Catalogue of the region within thirty miles of the city of New-York. The subject was referred to a committee, upon whose recommendation the following gentlemen were appointed to arrange the catalogue.

President Delafield, on minerals; Professor Torrey, phenogamous plants; Mr. Halsey, cryptogamous plants and arachnides; Dr. Dekay, zoophytes, fishes, mammalia, and annelides; Major Leconte, insects; Mr. I. Cozzens, crustacea; Mr. Cooper, mollusca, reptiles, and birds.

February.—Professor McVickar presented, among other minerals, specimens of anthracite from the Great St. Bernard, found at a height of one thousand feet above the Convent, (Hospice.)

At the anniversary meeting, on the 28th inst., the following officers were elected for 1831:

President, Joseph Delafield; 1st Vice-President, Abraham Halsey; 2d Vice-President, Dr. J. E. Dekay; Corresponding Secretary, Dr. J. Van Rensselaer; Recording Secretary, Dr. J. J. Graves; Treasurer, Wm. Cooper; Librarian, Dr. J. E. Dekay.

March.—Mr. Cooper read a notice of several birds seen by him in the neighborhood of the city of New-York during the past winter, which he stated were not usually noticed at that season. The same gentleman read a communication from Major Leconte, stating tha the had recently discovered two new species of Unio, and had heard of four others, one of which is spinous. In plants, he had discovered a new species of Thymus, and a new genus allied to Gerardia.

May.—Mr. Cooper, from the committee on the catalogue, read a report on the birds in the vicinity of the city of New-York, accompanied by a catalogue of the species, with preliminary remarks on their migration and geographical distribution.

Mr. Cooper stated that the large collection of bones recently disinterred at Big Bone Lick, Kentucky, were then in the city, and belonged to Messrs. Barber and Graves—that it contained fourteen or fifteen tusks, ten or eleven lower jaws, and a skull, nearly perfect, (of the Mastodon,) with a large quantity of bones, stated to belong to nearly 20 different species, forming a variety and extent unrivalled, as follows: bones and teeth of fossil elephant, mastodon, horse, ox, deer, and megalonyx; of the latter genus, parts of the right lower jaw with four teeth, a separate tooth, clavicle, tibia? and perhaps other portions now for the first time discovered as belonging to that animal. (The report, relating to these bones, and presented to the Lyceum, was subsequently published in this Journal.)

September.—The President announced the death of their late member, Dr. Samuel L. Mitchill, whereupon, a resolution, expressive of the feelings of the Lyceum, and of the loss which science in general had sustained, was unanimously passed by the Society. A resolution was also passed, that Dr. Samuel Akerly be requested to draw up a biographical memoir of the late Dr. Mitchill.

November.—Dr. Gale exhibited for inspection specimens of several different alloys of sodium and potassium, a number of which were liquid at the ordinary temperature, (60° Fah.;) one, containing 12 parts of potassium and 1 of sodium, was so light as to float on naphtha, and congealed at the freezing point of water. Dr. G. stated, that this alloy was a remarkable instance of expansion, from the union of two different bodies, and that from the liquidity of the alloy, we should infer, according to the laws of caloric, that much heat would have been absorbed, and consequently a considerable diminution of temperature would follow; on the contrary, an elevation of temperature was the consequence of the union.

During the present year many valuable donations have been received, and the following gentlemen elected as members:

Resident—S. T. Carey, Dr. Thomas D. Devan, Benjamin Pike.

Corresponding—Wm. R. Clapp, Philadelphia; Professor Dobereiner, Jena; Professor Breithaupt, Freiburg; Mr. M'Gillivray, Edinburgh; Don Claudius Gay, Valparaiso.

ABSTRACT FOR 1832.

January.—Dr. Perrine, U. S. Consul at Campeachy, read a paper on an article used in the manufacture of cordage, and brought to our market under the name of Sisal Hemp. It is stated, by the author, to be a species of Agave, (Agave Americana,) growing wild in great abundance in Yucatan.

Professor Torrey read a paper from the Rev. L. De Schweinitz, entitled "Remarks on European plants, which have been more or less naturalized in the United States."

Mr. Cooper communicated a paper on the anatomy of the Wild Swan, (Cygnus Bewickii,) of Long Island, and exhibited parts of the skeleton of this animal.

Dr. Feuchtwanger read a paper on Lucullite or black marble.

Dr. Akerly exhibited for inspection numerous relics from a temple in the ancient city of Palenque, in Central America.

February.—At the anniversary meeting, on the evening of the 27th inst., the following gentlemen were elected officers of the society for 1832:

President, Joseph Delafield; 1st Vice-President, Abraham Halsey; 2d Vice-President, J. E. Dekay; Corresponding Secretary, Dr. J. Van Rensselaer; Recording Secretary, Dr. L. D. Gale; Treasurer, Wm. Cooper; Librarian, James E. Dekay.

March.—Professor Torrey read an interesting communication from Dr. Johnson, of Chiapas, on the history of the Mexican Albinos, and was requested to forward the communication to Professor Silliman for publication.

April.—Dr. Gale read a paper, entitled "Observations on the bases of the alkaline earths, earths proper, new method of separating some of these bases, and on the new metals, Thorium, Pluranium, Ruthenium, and Vanadium.

Dr. Dekay read a paper on the volcanic islands which appeared in the Mediterranean, in 1831.

May.—Dr. Harlan, of Philadelphia, presented a variety of casts of the fossil Megalonyx, chiefly from White Cave, Kentucky, most of them unique and highly interesting specimens. Mr. Cooper made some verbal remarks on these fossils, and demonstrated the osteology of the parts hitherto known.

June.—Mr. J. Finch gave an account of some geological observations made by himself on the region in the vicinity of Lake Erie and the River St. Lawrence, in which he pronounced the basin of those regions to be principally *tertiary*; he also gave an account of the columnar limestone found in the vicinity of Kingston, U. C., and on the Island of Montreal.

Mr. D. J. Browne, of Boston, announced a locality of *Fulgorite*, at Gurnet's Point, near Duxbury, Mass., being the first locality noticed in the United States.

October.—Dr. George W. Boyd read a paper entitled, "Observations on the Mineralogy and Geology of the gold region of the southern United States," and also presented an extensive suite of characteristic specimens. Dr. B. considers this region decidedly *primitive*, and also that the *auriferous deposites* have no connection with the *veins* at present worked.

Mr. Dewey reported on the Geological Text Book of Professor Eaton, in which he stated, that although the work contains many valuable facts, yet for a text book he considers the arrangement a bad one.

November.—Mr. Sampson read a paper on a cetaceous animal, (Delphinus Globiceps,) lately stranded on Fairfield beach, state of Connecticut, of which Mr. John I. Glover gave a sketch and description at a former meeting.

The President read a communication from John E. Holbrook, M. D., Professor of Anatomy and Physiology in the Medical College of Charleston, S. C., stating that he proposes publishing a work on the Herpetology of S. Carolina and Georgia.

December.—Dr. Feuchtwanger read a paper, entitled "Observations on Nickel, and its application in the preparation of the new metal, Argentine or New Silver," in which he described most of the ores of Nickel, and the various modes of reducing them.

Dr. Dekay presented a suite of specimens illustrative of the geology of the island of Mytilene, the Dardanelles, the Bosphorus, the neighborhood of Smyrna, and the Asiatic shores of the Black Sea, accompanied with observations.

Numerous donations in nearly all the branches of Natural History have been received from members and correspondents.

The following gentlemen have been elected as members during the present year:

Resident—Dr. Wm. Baxter, Dr. R. P. Tanner, Dr. J. C. Jay, Wm. F. Deming, Dr. J. M. Leon, Frederick Prime.

Corresponding—Alonzo Clarke, Williamstown, Mass.; Dr. H. Perrine, Campeachy; Counsellor Dr. Keugg, Berlin; Capt. F. A. Fokkes, Hamburg; George Gibbs, jr. Turks Island; Professor Naccari, Chioggia, Venet. Terr'y; Col. Ed. Clarke, Saugerties, N. Y.

ABSTRACT FOR 1833.

January.—Dr. Dekay read a paper on the Gaviel of New-Jersey, of which he exhibited to the Society a considerable portion of a lower jaw discovered there by Lieutenant W. W. Mather, of West Point, from whom he also read a letter communicating some geological observations on this region.

Mr. Cooper read a report on the specimens of Megalonyx referred to by him at a previous meeting. They consisted of several phalanges of the fore foot, and there is reason to presume that they formed part of the original specimen made known by Mr. Jefferson.

February.—At the anniversary meeting, held on the 25th instant, the following gentlemen were elected officers for 1833:

President, Jos. Delafield; 1st V. President, Abm. Halsey; 2d V. President, John Torrey; Corresponding Secretary, Dr. Jeremiah Van

Rensselaer; Recording Secretary, Dr. Jas. E. Dekay; Treasurer, Wm. Cooper; Librarian, Dr. J. C. Jay.

April.—Mr. Cooper read a communication from Professor Troost, of the Nashville University, entitled, "Description of a new genus, Acontia, and of two new species of Heterodon, accompanied with drawings."

Under the genus Acontia, the author describes two species, viz.:

Acontia leucostoma, or Cotton Mouth, with poisonous fangs.

Acontia atrofuscus, Highland Mokeson, Copper Head, Pilot, &c.

Under the genus Heterodon the author enumerates 3 species, viz.:

Heterodon niger of Beauvais.

Heterodon annulatus of Troost, inhabits swamps.

Heterodon tigrinus of Troost. All of which are found in Tennessee.

Dr. Gale read a report on Dysodile or mineral paper, presented at a former meeting by Capt. Perry, and referred to Dr. Gale for examination and report.

May.—Dr. Samuel L. Metcalf read a paper entitled, "A New Theory of Terrestrial Magnetism," in which he maintains, 1, the identity of caloric and electricity; that atmospheric electricity or lightning results from the accumulation of caloric in aqueous vapor, and from its rapid passage out of vapor into bodies which contain less of it. 2, that galvanic electricity is produced by the oxidation of metallic plates in acids or alkalies; that its properties vary according to the size and number of the metallic plates, and the rapidity of their oxidation. 3, that common electricity is derived from the atmosphere, and from other bodies, by pressure, and by friction; in short, that the latent caloric of all bodies is convertible into heat or electricity, according to the mode of its disengagement from other matter.

He further maintained, that caloric is the cause of all the powers and motions of other matter; that it is the combining force in cohesive and chemical affinities; that it is the cause of capillary attraction, and of gravitation; that it is the cause of light, by expanding common matter into a state of extreme diffusion, until it becomes phosphorescent and imponderable. He also maintains that the aurora borealis is produced by the caloric which is given out by the upper current of the atmosphere, as it passes from the tropical to the polar latitudes, by which it is greatly condensed; and further, that caloric is the source of *all life* and motion throughout creation.

In part ii. he endeavored to show, that magnetic polarity was caused by the passage of radiant caloric from the tropical to the polar latitudes, because the force of magnetic power coincides with the coldest points in the polar regions. He maintained from numerous analogies, that if the whole earth were of uniform surface and elevation, the true north and south poles would be the centres of the greatest cold, and of magnetic action, and that there would be no variation of the needle; but that, from the varied distribution of land and water, mountains and plains, they followed a corresponding variation of territorial temperature in the same latitudes, which was also accompanied by a corresponding variation of the needle. He maintained that the unusual accumulation of ice in the polar seas caused a shifting of the magnetic poles; that they are further north during summer than winter; that their movements are sometimes eastward, and at other times westward, but not uniformly so. He further showed, that all the variations of the needle, annual, monthly, and diurnal, uniformly obeyed the variations of terrestrial temperature. He has identified all the phenomena of magnetism with the fundamental doctrines of climate; and the whole work may be considered as an attempt to resolve all the motions and changes which take place throughout nature into the agency of a simple and universal element. He considered the relations of caloric to ponderable matter as the basis of the whole structure of physics.

This treatise has been since published under the above title.

July.—Mr. Partridge exhibited specimens of pink-colored silk, dyed by the flowers of the Monarda didyma, or sweet balm.

August.—Dr. Swift, U. S. N., exhibited some new and singular reliques recently disinterred from the ancient city of Palenque in Central America.

September.—Dr. Akerly read a communication, entitled "Extracts from a correspondence of Don Francisco Corroy of Tobasco, in relation to the antiquities of Palenque."

Many valuable donations have been received by the Society during the present year, of which are mentioned a large box of interesting Swedish minerals, received from H. Wheaton, Esq., Charge d'Affaires from the U. S. to the Court of Denmark; and also a box of minerals, marine and fresh water shells, and corallines, from H. Perrine, Esq., U. S. Consul at Campeachy.

The following gentlemen have been elected as members during the present year:

Resident—Jos. Foulke, jun., Dr. Edward Ludlow, Dr. William Edgar, Dr. S. L. Metcalf, Dr. Minturn Post, J. M. Bradhurst, Hen. C. Brush, Rufus Prime, William Partridge, R. H. Brown, Dr. W. C. Wallace.

Corresponding—M. V. De Meleon, Paris; Dr. Thos. Dillard, U. S. N.; Dr. J. Finch, London; Don Francisco de Corroy, Tobasco; Dr. A. Adee, U. S. N.

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AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

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State Prison Labor.

[From the Buffalo Whig.]

Since the Mechanics' Convention, upon the subject of our States' Prison labor, some notice of the facts, it seems, is deemed advisable by "the powers that be." Printed circulars have been despatched by the keeper of the Auburn Prison, of which a copy follows below. Several have been received in this city, and they have probably gone to all parts of the State. The circular follows:

State Prison, Auburn, August, 1834.

Dear Sir,—You are doubtless aware that latterly considerable excitement has existed in many parts of the State, relative to the employment of convicts in mechanical labor in the State Prisons. Feeling deeply the importance of the subject, as connected with our penitentiary institutions, and anxious to learn as far as possible the effect which that labor has upon the citizen mechanic's interests, as well as the effects of our prison system upon our discharged convicts, allow me to solicit your answers to the following interrogatories:

1st. Are you acquainted with any persons who have been discharged from either of the State Prisons? and if so, what are their names, places of residence, and what has been their conduct, habits, and character, since their discharge; also before conviction, if known?

2d. What branches of mechanical or other business do they prosecute, and to what extent?

3d. Are there any articles manufactured in the prisons of the State sold in your place? and if so, what kinds, and to what amount per annum?

4th. Does the mechanical business of the prisons injuriously affect the interests of the mechanics of your place? and if so, is it in the price or the quantity brought into your market, or any other cause?

The information above sought, is not merely important to the State, but to the United States, as well as to European nations, inasmuch as it involves the permanency of a system of prison discipline, which has been considered the best extant, and which, in truth, has constituted a new era in the punishment and reformation of criminals in this country, and is now receiving the attention of the governments of Europe.

I therefore trust the subject will be considered of sufficient importance to claim your early and serious attention.

I am, with great respect, your obedient servant,

Levi Lewis,
Agent and Keeper.

To —— ———, Buffalo, Erie Co.

The following answers to the third and fourth interrogatories were prepared by one of our mechanics, to be forwarded to the keeper of the prison:

Answer to third interrogatory.

There are a number of articles sold in Buffalo which are manufactured in the prisons of this State, to wit: joiners' tools, saddlery of all kinds, both brass and plated, hames, saddle trees; copper ware, such as furniture for cook stoves, &c.; blacksmith work of various kinds, such as iron doors, grates, bars, bolts, locks, chains, and hinges; wooden ware, such as tubs, pails, churns, &c.; ready made clothing, and it is believed boots and shoes; combs, and several other articles, some of which are purchased in New-York, at second hand, without the purchaser's being aware of the articles being manufactured in the prisons.

The amount of articles sold in this city the last year, from the best data that can be obtained, exceeds fifteen thousand dollars—one house disposing of about one fourth part of this amount.

Answer to the fourth interrogatory.

The several mechanical branches with which the prison wares have come into competition are seriously injured, and it is said some establishments have been broken up in consequence, and that others must follow.

It is believed that the low price at which the prison wares are sold is the principal cause of complaint, it being on some articles but little above the price of the raw material.

The manufacture of some articles which are carried on pretty extensively, have, in consequence of the introduction of the same

kind of articles manufactured in the prisons, been entirely discontinued—an establishment for manufacturing hames, employing from 10 to 12 workmen in 1830, has been entirely abandoned.

Copper furniture for cooking stoves, manufactured in the prisons, was introduced into this city in 1833, and offered at prices considerably below what it cost to manufacture it. The consequence has been, that the prison ware is now extensively sold, and will, if this is persisted in, supersede all other. There are about six or eight establishments now in Buffalo for the manufacture of copper, tin, and sheet iron ware, employing about 50 workmen. The conductors of these establishments say it is impossible for them to compete with prison prices. The iron work for the new county prison, erected in 1832 and '3, was wrought at the Auburn Prison, consisting of doors, grates, locks, &c. &c. amounting to more than two thousand dollars.

Whether any answers to queries one and two have been returned we are not informed. We were recently acquainted with a very worthy mechanic in this city, now deceased, who, previously to his residence here, was employed in superintending the blacksmiths in the Auburn prison. That trade he followed here; and from his knowledge of the discipline of the prison, and the signs by which the prisoners (not being allowed to speak) call for what they need, he often detected those he had employed as graduates of the Auburn institution. He informed us that he detected in this way from fifteen to twenty of these, in the course of two years. Several of them proved most arrant knaves; and no one so demeaned himself as to retain his place longer than a few days. Some of them pilfered his small tools, and one broke open his shop at night and robbed it. A chairmaker, also at work here, plundered his employer and decamped, who was from the same school.

In short, reformation, we believe, can seldom be found to have resulted from our prison system.

The Central Committee of the Mechanics' Convention of the State of New-York addressed the following communication to the several candidates in nomination for Governor and Lieutenant Governor, at the recent election, and received the subjoined replies.

Utica, October 14, 1834.

Sir,—The Central Corresponding Committee of the State Convention of Mechanics have been instructed to request of the several candidates for Governor and Lieutenant Governor, their respective views on the subject of employing the convicts in our state prisons at mechanical labor, as at present conducted, and to communicate the same, when obtained, to the several county corresponding committees.

To enable the candidates more distinctly to understand the object of this inquiry, a copy of the proceedings of the State Convention of Mechanics is forwarded by mail to each.

Any communication you may think proper to make on the subject, addressed to the subscriber, in this place, will be duly communicated to the several corresponding committees.

An early compliance with the above request will be justly appreciated by the mechanics of this state.

By order of the State Central Committee of Correspondence,

Rudolph Snyder, Chairman.

Oxford, October 17, 1834.

Sir,—I have the honor to acknowledge the receipt of your letter of the 14th instant, written in behalf of the Central Corresponding Committee of the State Convention of Mechanics, requesting my views on the subject of employing the convicts in our state prisons at mechanical labor, as at present conducted.

I cheerfully comply with the request of the committee, and, in doing so, make known to you sentiments I have long entertained and expressed.

Believing that the mechanics of this state have reason to complain of the state prison system in regard to mechanical labor, as at present conducted, I think justice to them requires that the laws upon which that system is founded should be so altered as to remove the causes of complaint, and to prevent the injurious consequences resulting to that respectable and highly meritorious class of citizens.

I am, sir, very respectfully, yours,

John Tracy.

Mr. Rudolph Snyder, Chairman of the State Central Committee of Correspondence.

Auburn, October 17, 1834.

Sir,—It would have been much more agreeable to me not to appear before the public during the ardent if not angry discussions which precede the approaching election. I am aware to how much misconstruction and misrepresentation such a proceeding is exposed. I have abstained from the avowal of my sentiments upon various matters which have been heretofore the subject of discus-

sion, because my opinions on those subjects could be collected from public acts in the ordinary discharge of legislative duties. But the subject to which you invite my attention is one which no public opportunity has been hitherto afforded me to express my opinions. Still this consideration would not induce me to appear at this time before the public, if I did not feel compelled to that step by a principle of conduct which I have ever cherished and maintained. It cannot be denied that it is the right of every citizen to ask, and of every candidate for public office to give, an expression of his views upon any important question of public policy, in relation to which, if elected, he may be called upon to act officially. To deny this principle in an elective government, where the representative is to express the will of his constituents, would be to deny the principle on which the government itself rests.

I answer the communication you have addressed to me with the more pleasure, because it comes in such a shape as to be entitled to be regarded as the act of that enterprising and patriotic class of citizens of this state who are engaged in mechanical pursuits. I am required by the committee to express my views on the subject of employing convicts in our state prisons at mechanical labor as at present conducted. To this inquiry, I say explicitly, that there must be a radical error in any system which substitutes the labor of felons, the outcasts of society, for the industry of honest and enterprizing citizens, and which drives those citizens from the pursuit of their lawful and meritorious callings. Still, I am and ever have been a friend of the penitentiary system, in the place of sanguinary punishments. Without going more minutely into the details of the present system, than the occasion will warrant, it is proper to remark that the physical force of the convicts at Auburn, averaging at least six hundred for a number of years past, controlled and directed by the admirable police which prevails there, and aided by both steam and water power, has converted that prison into an immense manufacturing establishment, which might be expected to yield a revenue greater than all the manufactories in any town in the state; and yet the fact is, that prison yields a surplus revenue of only some $3000 or $4000 annually. It is evident, therefore, that the advantage to the state, even in a pecuniary point of view, bears no comparison to the enormous extent of the injury inflicted upon the interests of citizens engaged in manufacturing pursuits. The result unquestionably is, without its having been anticipated by the benevolent founders of the penitentiary system, that the state prisons have been converted into a monopoly of the mechanical business, ruinous to that portion of our fellow citizens who have been educated for mechanical pursuits, and which brings them into an odious comparison with felons, without any equivalent to the public. I cannot hesitate in saying, that such a monopoly is in principle unjust, and that it ought to be corrected. Every citizen, and all classes of citizens, have a common and equal interest in the administration of justice, and the punishment of crime, and the burthen of the expense incurred in the promotion of those objects, like all other public expenses, ought to fall equally upon all, in proportion to the taxable property; and any system which violates this principle, either directly or indirectly, is subversive of that equality in rights and duties which is the foundation of our government. Least of all, should such a burthen fall upon the mechanic, agriculturist, or any other portion of the people who derive their property by actual labor, for the plain reason that they are the least able to bear it.

Whatever difficulties there may be in relation to this subject, (and I confess that, to myself, in common with others, when this subject was first agitated, they seemed to be of a serious character,) I cannot doubt but that it is in the compass of legislative wisdom to devise and perfect a system which will relieve the mechanics from the present injurious consequences to them and their business, of which they so justly complain, and at the same time to enable the convicts to support themselves. I do not doubt that branches of industry may be pursued by them which will attain that end, and that will not conflict with the ordinary mechanical business of the country. It has occurred to me, that the production of silk and its manufacture might be advantageously substituted for the present employment of the convicts. But I have not had sufficient time, or information on the subject of its culture, to come to any conclusion on this particular branch of the subject. I allude to that experiment, for the purpose of showing that the subject of the employment of convicts is a large and wide field, open to great improvements, and that there is no insuperable difficulty in arranging a system equally beneficial to the state at large and to the mechanics. Certain it is, that such a system seems to us no more impracticable than the attainment of the present condition of penitentiary discipline did fifteen years ago. Indeed, experience has proved that in political science, as well as in

the mechanic arts, the greatest obstacle to improvement is the belief that perfection is already attained.

I am, sir, with great respect for yourself and the other members of the committee, your fellow citizen,

W. H. SEWARD.

RUDOLPH SNYDER, Esq., Chairman of the Corresponding Committee of Mechanics' State Convention.

Albany, October 18, 1834.

SIR,—I have received your letter of the 14th instant, written in behalf of the Central Corresponding Committee of the State Convention of Mechanics, requesting my views "on the subject of employing the convicts in our state prisons at mechanical labor as at present conducted." The views and feelings of that portion of our citizens engaged in mechanical business, disclosed lin their memorials, and by their committees to the Legislature at its last session, impressed me with the importance of the subject, and I united my efforts with those of the persons particularly interested, to have such an investigation instituted, relative to the effects of the present system, as would enable the Legislature to judge correctly of the evil complained of, and to apply the proper remedy.

That the labor of convicts in our state prisons, as now conducted, is injurious to several branches of mechanical business, is generally conceded, and the only diversity of opinion on the subject is as to the extent of the injury and the practicable means of removing it. The evil being admitted, it is the imperative duty of the legislature to apply a corrective, and I shall exert my influence, in whatever situation I may be, in favor of all proper measures for the attainment of that end. That any class of citizens who yield obedience to the laws, and contribute to the support of government should be injured by the means used for the punishment of malefactors, is manifestly unjust; a system of prison discipline which necessarily produces such a result is clearly wrong; and a government which sustains it, neglects one of its obvious duties, the duty of protecting the equal rights of all. It is consoling to our humane feelings, to believe that penitentiaries have enabled the governments which have established them to dispense with sanguinary punishments in almost all cases, and otherwise to mitigate the severity of their penal code, with at least an equal chance of preventing crimes, and a much greater one of effecting reformations. I still cherish this belief. The evils complained of are not in my opinion the inevitable effects of the penitentiary system, and I feel confident that they can be remedied, and all the good expected from this system, (except perhaps only that of making the labor of convicts a source of revenue,) be fully realized. It must be admitted that the return to the bosom of society of those who have been the inmates of state prisons, and still retain their vicious propensities, is a great moral evil, which may, I hope, be somewhat mitigated by judicious regulations on this subject; but it cannot, I fear, be wholly prevented, without effectually destroying all the hopes of those who have resolved on reformation. The great difficulties attending this part of the subject should not, however, cause it to be abandoned in despair. I indulge a confident belief that the committee, who are examining this subject in all its bearings, will present such facts and views, not only in regard to the injurious competition of the labor of convicts with the industry of our mechanics, but also in relation to the moral evil above mentioned, as will enable the next legislature to fulfil the just expectations of those who suffer by this competition, and of the community at large in respect to this moral evil. To accomplish these objects I shall most cheerfully exert my influence.

I am, with great respect, yours, &c.

W. L. MARCY.

RUDOLPH SNYDER, Esq., Chairman, &c.

The following copy of the letter sent to the Central Committee of the Mechanics' Convention, Utica, was furnished to the undersigned on Saturday, by Mr. Stilwell, in consequence of not having been received by said Committee in time to be inserted in their circular received here on that day.

JOSEPH P. SIMPSON,
Chairman Cor. Com., N. Y.

New-York, October 28, 1834.

SIR,—Your favor is before me, and has received that consideration which its importance merits.

My views on the subject to which your letter has called my attention have been freely expressed for years past, and are before the public. It will not, therefore, be necessary for me to say much at this time.

I have long since been convinced that a radical change should be made in the application of convict labor, and indeed the whole economy of our state prisons.

As a legislator, I have constantly felt the necessity of providing a remedy for every admitted evil, but time and public sentiment are required to effect all the changes we desire. The method which has been adopted

by you is of all others the most certain of crowning your labors with success. And we may now indulge the hope, that the time is at hand when the constituted authorities will present this subject in a proper manner before the Legislature of this State.

I have long labored in the cause in which you are engaged, and whether in public or private life, I shall continue to feel the same desire for the success of correct principles and the enactment of wholesome and just laws. I remain your fellow citizen,

SILAS M. STILWELL.

To RANDOLPH SNYDER, Esq., Chairman of Central Committee of Mechanics' Convention.

[From the New-York American.]

The opinion is now generally prevalent, that some change must be made in the employment of the inmates of our State Prisons, to relieve the mechanical classes from the effect of their competition, and this opinion will doubtless be confirmed by the report of the committee to the next Legislature. The question will then arise—in what way can the change be best effected?

In reflecting upon the subject, the following plan has occurred to me, and I offer it as a suggestion. Good roads are among the most important public conveniences, diffusing their benefits universally, and they are also one of the best investments of public wealth. Their construction will *interfere* with none of the general avocations of society, but, on the contrary, will directly or indirectly promote the interest of all pursuits. Can the labor of the convicts be applied to this object? I think it can without inconvenience or difficulty, and at the same time the present prisons be useful auxiliaries to the plan, which I will concisely describe.

The convicts to be divided into companies of ten, twenty, or thirty, or as many as one individual can manage; each company to be provided with a strong moveable prison, composed of apartments, say four by seven feet, equal to the number of the company, for security at night, with moveable accommodations for cooking, &c. &c.: all of which is entirely practicable. A corps of engineers, for the survey and direction of the construction of roads on a great and permanent scale, to be established, who shall direct the operations. When a continuous line of road is decided upon, these companies to be placed upon it at proper distances, and employed upon it till it is finished in the best manner possible. When this is completed, then move to another, until the whole State is traversed by good roads, if we are so unhappy as to have convicts to construct them.

If the prison at Sing-Sing could be made as it was, there is not the least difficulty, by the adoption of a similar system of management, of applying the same labor to the object proposed.

The operations to commence on the 1st of April, and be continued until the 1st of December—eight months: the convicts then to return to their respective prisons, and spend the winter in the acquisition of knowledge, and in the duties of religion, with the exception of such labor only as would be useful to their winter establishments, and in preparation for their summer campaign at road-making, rendering it a season of rest and moral improvement, to which they might look forward during their months of toil with hope and pleasure, and which, by being continuous, would be more efficient, as constant application to any given subject is more efficient than the same efforts, if desultory.

These are mere hints, to induce reflection in those to whom is entrusted the direction of these important matters, and I feel satisfied they are practicable, and deserving of at least a trial, the best mode of testing any project of importance. HANCOCK.

A MECHANIC OF TALENT IN HIS PROPER STATION.—The workmen of Paris deputed M. Ch. F. Berenger to represent them at the late Scientific Congress at Poitiers. This gentleman, who was formerly a journeyman watchmaker, has by his strong sense and his talent raised himself to a very respectable rank as a writer, and has published a series of remarkable articles on social reform in a journal called *Le Bon Sens*, which is under the direction of M. Cauchois Lemaire. His instructions were not only signed by a number of operatives, but by the two principal editors of a daily Paris journal, several men of letters, tradesmen, and respectable women. The objects of his mission were to call universal attention towards the gradual suppression of customs' duties; to point out the evils of the municipal financial system of France, whereby there were as many custom-houses established as there were towns having an octroi; to insist upon the necessity of a better system of education for artists, agricultural laborers, and women, and of an augmentation of the wages of the latter; to suggest measures for putting an end to the hostility between workmen and their employers, and also to call attention to the increasing number of illegitimate children. M. Berenger's expenses were provided for by the voluntary contributions of his constituents, who also mentioned in their instructions, in case po-

litical questions should be entered upon at the Congress, they suggested that the most essential points to be considered would be a more extended scale of eligibility for deputy, that the deputies should be suitably paid for their services, &c. &c.—[French paper.]

The Principles and Practice of Constructive Carpentry, being a Full and Complete Treatise on the Theory and Practice of Carpentry and Architecture, compiled from the Works of Tredgold and Nicholson, and other Authorities, with the Latest Improvements in every Branch of the Art. Royal 8vo. No. 1: New-York, W. Norris, 1 Nassau street.

It has ever been our decided opinion, that a most important part is performed, in the extension of knowledge, and in promoting the general advancement of society, by the publication of treatises on the mechanical arts.

Mathematical, like every other kind of science, remains a dead letter until it be applied "to the business and affairs of men;" on the contrary, however, when it is applied to the useful arts, it extends the views of the artist, substitutes certainty for uncertainty, security for insecurity; it informs him how to raise the greatest works with confidence, and how to produce stability with economy, or, in its own language, how to obtain a maximum of strength with a minimum of materials.

There is perhaps no class of mechanical arts so directly capable of receiving improvement from the researches of men of science, as those connected with building; neither is there any that has received a greater share of their attention. But these researches have not benefitted practical men in proportion to the extent to which they have been made. They are too often given to the world in works which are either so expensive as to be inaccessible to the greater number of men of business, or so completely scientific as to be almostuse less to all but men of science themselves. Something may also be attributed to a kind of distance and jealousy which appears to exist between theoretical and practical men; and which has, perhaps, sometimes prevented the practical mechanic from benefitting by scientific researches, the results of which have been within his reach. But these prejudices are fast wearing out. Of this fact we need no better proof than the encouragement which begins to be given to popular treatises on mechanics, to mechanics' magazines, and to the formation of mechanics' institutes.

One or two attempts have already been made to treat the subject of CARPENTRY on mathematical principles. "The Carpenter's Guide," by Peter Nicholson, is a very excellent and justly popular work, but it is almost entirely confined to what is termed "finding the lines;" and although it fully developes the methods of geometrical construction, it does not enter at all into those mechanical principles, a knowledge of which is necessary to enable a carpenter to tread with certainty and economy out of the usual routine of his operations. This part of the subject has, however, been taken up in "Elementary Principles of Carpentry," by Thomas Tredgold, civil engineer; and he who possesses these two treatises, and can understand them, need scarcely wish for any other work upon the subject. But in both of them, especially in the latter, a great many algebraic formulæ are used, which but few practical carpenters or builders understand; moreover, to purchase both of those works may be beyond his means, especially at that period when it is most desirable that he should be in possession of such works.

The work before us is intended to combine the whole substance of both these treatises, with such additional matter as may have been accumulated since the time of their publication. Something is promised on the construction of canal locks and water wheels. The architectural part will also be more full than is general in such works. The number just published contains a short system of practical geometry, with part of a treatise on the equilibrium and pressure of beams, illustrated by three copper-plate engravings. The mechanical principles are exhibited in a plain and simple manner, mathematically correct, yet without requiring more previous mathematical knowledge in the reader than is necessary to work a rule-of-three question. The general object of the work is well expressed in the following extract from the prospectus:

"The work is compiled with especial reference to the operative carpenter. It is intended for the use of the workman or the apprentice who may wish to gain a more extensive knowledge of his art, and who may aspire to such skill and information as will enable him to design and execute the greatest works with elegance and durability, and in due time to assume the highest standing in his profession—a point which any man may honestly aim at, and to which a good resolution and vigorous exertion, properly directed and persevered in, will seldom fail to conduct him. To aid such laudable efforts is one great object of this work. But it is not to the carpenter only that an acquaint-

ance with the principles of construction is useful—such knowledge is almost equally necessary to the architect, the civil engineer, and all persons in any way connected with building. 'Construction is the anatomy of architecture; it is the very base upon which the art of design must be founded, and on the nature of the base must depend the excellence of the superstructure.'

"Although the 'Principles and Practice of Constructive Carpentry' will be compiled in such a manner that it may be readily comprehended by a mechanic of the humblest education, it will contain much practical matter, both original and copied, that will be of great utility to individuals of higher acquirements; and much useful information, which can only be obtained by long experience, or which lies scattered through a number of expensive volumes."

The proposed arrangement of the work is excellent, beginning with simple principles and regularly progressing to the most elaborate workmanship. The typographical execution is of the first quality, and the publisher appears to have spared no expense in order to bring the subject in as clear and pleasing a manner before the physical, as the writer has brought it before the mental eye of the reader.

We would earnestly recommend the study of such works as this to all mechanics. No man can know too much concerning the business by which he obtains his bread, and on which hangs all his hopes of rising in the scale of society. Other kinds of knowledge *may*, this is *sure*, to be useful to him. Such knowledge he *must* possess, if he would ever rise beyond mediocrity in the exercise of his art. And to those who are not already in possession of good works of the kind, we would recommend "the Principles and Practice of Constructive Carpentry." The method of publication, in monthly numbers, 25 cents each, renders it accessible to every one; and, from what we have already seen of it, we have no doubt that it will prove a most useful and practical work.

Crystalline Lenses.—Sir David Brewster, a very distinguished writer on the science of optics, is desirous of procuring crystalline lenses, or, in other words, magnifying glasses of the eyes of American animals. Put the entire eye into a well corked and sealed bottle of spirit, or take the lens from the globe, and throw it for a few minutes only into boiling water. When taken out, dry it and wrap it in paper, writing upon it the name of the animal to which it belonged.—[Scientific Tracts.]

Connection between Science and Theology.—It is much to be regretted that we have no modern Rays, Derhams, Boyles, or Nieuwentyts, to make the light of our recent discoveries in science bear upon the illustration of the perfections of the Deity, and the arrangements of his providence. Since the period when those Christian philosophers left our world, many of the sciences which they were instrumental in promoting have advanced to a high degree of perfection, and have thrown additional light on the wisdom and intelligence of the Divine mind, and the economy of the universe. Natural history has widely enlarged its boundaries; our views of the range of the planetary system have been extended; the distant regions of the starry firmament have been more minutely explored, and new objects of magnificence brought within the reach of our observation. The nature of light has been more accurately investigated, the composition of the atmosphere discovered, the properties of the different gases ascertained, the powers of electricity and galvanism detected, and chemistry—a science completely new-modelled—has opened up the secret springs of nature's operations, and thrown a new light on the economy of Divine wisdom in the various processes which are going on in the material system. Is it not unaccountable, then, that no modern system of *Physico-Theology*, embracing the whole range of modern discoveries, should have proceeded from the pens of some one or other of our most distinguished philosophers! Does this circumstance seem to indicate that, since the early part of the last century, the piety of philosophers has been declining, and the infidel principles of the Continental school gaining the ascendancy! Infidelity and fatalism very generally go hand in hand. When the truths of revelation are once discarded, a species of universal scepticism, differing little or nothing from atheism, takes possession of the mind; and hence we find, that in the writings of such men as Buffon, Diderot, and La Place, there is not the slightest reference to final causes, or to the agency of an All-pervading mind that governs the universe.

That the connection between science and theology we have been recommending is not a vague or enthusiastic idea, appears from the sentiments which have been expressed on this subject by the most eminent philosophers. Throughout the whole of the works of the immortal Newton, we perceive a constant attention to final causes, or to the great purposes of the Deity. It was the firm opi-

nion of this philosopher, "that, as we are every where encountered in our researches, by powers and effects which are unaccountable upon any principles of mere mechanism, or the combinations of matter and motion, we must for ever resort to a Supreme power, whose influence extends over all nature, and who accomplishes the wisest and most benevolent ends by the best possible means." Maclaurin, the friend of Newton, and the commentator on his *Principia*, expresses the following sentiments on this subject, in his "Account of Sir I. Newton's Discoveries." "There is nothing we meet with more frequently and constantly in nature than the traces of an all-governing Deity. And the philosopher who overlooks these, contenting himself with the appearances of the material universe only, and the mechanical laws of motion, neglects what is most excellent; and prefers what is imperfect to what is supremely perfect, finitude to infinity, what is narrow and weak to what is unlimited and almighty, and what is perishing to what endures for ever. — [Dick on the Diffusion of Knowledge.]

Supplemental Report of the Seventh Annual Fair of the American Institute.

The managers, anxious to do exact justice to the exhibitors, and to correct any errors that may have occurred in the confusion incident to a public exhibition, where more than five thousand articles were presented, have deemed it proper to make a supplemental report. They have been induced to do this, partly in consequence of certain facts having been brought to their knowledge since the exhibition, which, if known, would have varied their award. The extent of the fabrication of certain other articles of great utility, and of general consumption, demand a more pointed public notice than was given in the original report. They are satisfied of this, also, partly from information obtained since the exhibition, as well as from a careful review of the reports of the judges.

The case of incorruptible artificial teeth will first be noticed.

When the judges on these articles first met and reported, specimens from only two exhibitors had arrived. Afterwards, S. W. Stockton brought other specimens, and challenged competition. The successful competitor in the first instance consented to enter the list of competition again, and thereby waived the advantage he had acquired by the decision of the judges at their first meeting. At their second examination, the decision was unanimous in favor of Stockton's specimens. But the fact of this mutual agreement, and the waiving on the part of the party interested in the first decision of the judges, not having been positively ascertained, no notice was taken by the managers of either decision in the awarding of premiums. But the judges having subsequently certified that the last examination was with the consent and approbation of the successful competitor in the first instance, the managers have deemed it due to Mr. Stockton that he should be noticed; they therefore award to S. W. Stockton, of Philadelphia, a silver medal, for the best specimen of highly perfected incorruptible artificial teeth. And inasmuch as J. Plantou & Sons, of Philadelphia, exhibited the second best specimens, at both examinations, the managers award to them a diploma.

The managers have carefully examined into the extent and importance of the manufacture of watch dials, by Mullen & Ackerman, No. 101 Warren street, city of New-York. The accuracy and elegance of the workmanship, the facility with which they can be multiplied, the great demand they are competent to supply, and the saving effected for the consumers, entitle them, in the opinion of the managers, to a gold medal, in lieu of the silver medal heretofore announced, as the "reward of skill and ingenuity for the manufacture of gold watch dials."

And the managers also award to Mullen & Ackerman, a diploma, for handsome specimens of filagree jewelry.

Mr. T. Fossard's specimen of blue dye, the committee deem important. A cheap substitute for indigo would be of incalculable value; and the examinations the specimen underwent have made a favorable impression on the minds of the managers. They therefore did not hesitate to award him a diploma.

Matthias Ludlum, a journeyman mechanic, produced a beautiful brass tea-kettle and heater, which were made, by the consent of his employer, expressly for the Fair. They were exhibited in the name of D. E. Delavan, who, for these and other articles taken by him to the Fair, received a silver medal. Mr. Ludlum has since applied, and claimed the premium. It is desirable that the rewards of the Institute should, as far as possible, reach the ingenious producer, whose he is brought to a knowledge of the Institute. The managers, therefore, in accordance with the desire to reward obscure merit, award to Matthias Ludlum a silver medal, for a beautiful brass tea-kettle and heater.

Choice specimens of turned tool handles were exhibited by N. Cowenhoven. Mr. C.'s manufactured tools are sold extensively in

this city; he is entirely self-taught, and deserves a public notice for his ingenuity. The managers award to him a silver medal.

The managers also award to Alfred Willard, of Boston, a diploma for shell worked combs, elegantly carved.

To Francis Smith, for brass shovel and tongs, made by him, and delivered by Mr. Delavan at the Fair, the managers award a diploma.

They also award to Geo. Bird a diploma for imitation mouldings.

Miss Sarah Seager, 233 Thompson street, is entitled to praise for a handsome flower-piece, painted in oil. The managers award her a diploma.

Specimens of cut and pressed glass from the Union Glass Company, Philadelphia, were worthy of commendation.

Post's hame-collar block has met with much commendation.

Robert Fazon's improved cooking stove has also been highly approved; sold at No. 13 Bowery. A diploma is awarded him.

James Van Dyke, Brooklyn, Long Island, exhibited samples of excellent mustard made by him. It is hoped, as an American article, it will find favor with American consumers.

Messrs. E. & T. Fairbanks exhibited their patent portable scales, which are a convenient and excellent article—for which a diploma was awarded. A specimen model may be seen at the office of the Institute, No. 41 Cortlandt street.

T. W. Clisby, No. 12 Tenth street, exhibited an ingenious architectural engraving of the Ionic capital of the temple of Ilyssus, as described by the inventor. The illustrations profess to show the centres of the spiral scrawls of the volute, and to prove that they accord with mathematical principles. The engraving may be seen at No. 41 Courtlandt street.

A specimen of Asiatic marble, of the Brocia species, imported in its rough state, hewed and polished in this city—a beautiful article. Exhibited by Warren Gould. A diploma.

The managers have already granted to Obadiah Parker a gold medal for his artificial stone, and for the purpose of enabling him to make more public his discovery, they have, at his request, also awarded him a diploma.

To Charles Edwin Ely is also awarded a diploma for a finished specimen of ornamental writing engraving.

The managers award to Kutz & Adams, No. 330 Broadway, manufacturers of rules, mathematical instruments, &c., a silver medal, for two drafting scales, and two engineer sliding rules: specimens exhibiting great skill, accuracy, and elegance. An accompanying explanatory book shows the application of the different rules to multiplication, division, rule of three, tables of the areas and circumferences of circles, mensuration of superficies and solids, weighing of metals, &c.: a happy illustration of mental labor saving. They may be seen at the Library of the Institute, 41 Cortlandt street.

The managers, in accordance with the wishes of the Denny Manufacturing Company, and deeming the progress of the manufacture of the kind of articles exhibited by them of national importance, award to the said Company for their specimens of superfine black and blue broadcloths, in lieu of a gold medal, a silver pitcher.

The fanlight of T. Thomas—vitrified glass, displaying the American arms surrounded by the stars of the 13 States within a tri-colored border—deserves particular commendation for elegance of execution. The long lost but beautiful art of staining glass is revived and executed in New-York with a degree of perfection not surpassed perhaps by any of those relics of former times that have reached us. Mr. Thomas's specimen may be examined at No. 41 Cortlandt street.

Prize Essay.—The Hervean Society has given out the following subject for a prize essay for 1835: *The Influence of Atmospheric Pressure on the Animal Economy.* The prize to be won is a silver medal, with suitable inscriptions, or a quarto copy of the works of Dr. Harvey. The manuscript must be sent to William Moncrief, M. D., No. 7 York Place, or Richard Heric, No. 8 George Square, London, so as to be received by the first day of January next. Each dissertation must necessarily be accompanied by a sealed letter, containing the name and address of the writer inscribed on the back, with a motto, which motto must also be prefixed to the manuscript to which it belongs. There are many of our correspondents who might, with considerable prospect of success, send on an essay very seasonably.—[Scientific Tracts.]

Consumption.—Although Dr. Rush declared that consumption was wholly unknown to the American Indians, the famous Red Jacket, in an interview with a medical gentleman near Buffalo, in 1823, gave the particulars of no less than seventeen cases of pulmonary consumption among his relatives, including *ten* or *eleven* of his own children, who died of that insidious disease. —[Ibid.]

Ballooning.

Hartford, Oct. 4, 1834.

To the Editor of the Mechanics' Magazine:

Dear Sir,—I have this morning received the September number of the Mechanics' Magazine, and was somewhat amused to find that my plan for ærial journeying had been so nearly anticipated by B. G. N. However, I shall not contend with him about *flying*, but should be unwilling to have the public suppose that I had borrowed any thing from him, inasmuch as I had communicated my plan, with a drawing of the same, to Mr. Burden, of Troy, in January last; and had often expressed my confidence in it for ten years past.

There were some slight omissions in the communication of my plan, with regard to the method of ascending, &c., which I should be pleased to have corrected, as follows: After the words "vice versa," (which occur but once,) it should be read, "but the consumption of fuel and water may be counterbalanced, and the balloon may be made to ascend or descend occasionally, by its contraction or expansion, by means of the following arrangement. Eight small cords proceed from the inward sides of the eight long rods, and meet at the centre of the balloon, where they pass over eight small pulleys, and become united in one, which extends a few feet horizontally aft, and, passing over another pulley, proceeds downward, through a small aperture in the bottom of the balloon, to a small crank windlass, under the control of the engineer." Yours, &c.

RUFUS PORTER.

[In justice to Mr. Porter, we are bound to state that his communication was received prior to the publication of that of B. G. N. —ED. M. M.]

MAHOMEDAN MONTHS.—In chronology and history, as well as in all public documents, the Mahomedans use months of thirty and twenty-nine days alternately, making the year thus to consist of 354 days. Eleven times in thirty years one day is added to the last month, making 355 days, therefore, in that particular year. In common reckoning the year is purely lunar, consisting of 12 months, each one commencing with the appearance of the new moon, without any intercalation to bring the commencement of each year to the same season.—[Scientific Tracts.]

FROGS.—On exposing frogs to the temperature of 0° cent. 32° Fahr., in humid air, in order to suppress perspiration by evaporation, they lost by transudation, in different experiments, the thirtieth part of their weight. Transudation is more abundant in these reptiles than in man, though the latter may be placed in circumstances much more favorable.—[Ibid.]

Miscellanies, Foreign and Domestic.

[Continued from page 223.]

12. *Carrageen, or Irish Moss.*—Chondrus crispus, Lyngbye, Hydropt. Dan. p. 15, t. 4. Greville, Algæ Brit. p. 129, t. 15. Sphaerococcus crispus, Agardh, Sp. Alg. 1. p. 256. Fucus crispus, Lin. Syst. Nat. ii. p. 718. Turn. Hist. Fuc. p. 216–7.

This moss is common on rocks and stones, along the coast of Europe; it is also a native of the United States. A very variable species, but easily recognized when the eye is accustomed to it. The genus Chondrus belongs to the order Florideæ of the great natural family of the Algæ. All the species have a cartilaginous frond, which is flat, without nerves, dichotomous, dilated at the extremity, and of a livid reddish color; the fructification consists of scattered capsules, mostly immersed in the frond, rarely pedicellate; seeds minute, rounded.*

This moss, abounding on the southern and western coasts of Ireland, has been used by house painters for sizing; it has likewise been highly esteemed by the inhabitants as a dietetic remedy for various diseases, more especially for consumption, dysentery, rickets, scrofula, and affections of the kidneys and bladder. Dissolved by being boiled in water, a thick jelly is produced, more pure and agreeable than that procured from any other vegetable, which is found to agree better with the stomach than any prepared from animal substances. Its chemical composition appears to me, as far as I have been able to trace it, of very considerable importance; the jelly formed by dissolving it in hot water is not only composed of starch, but contains a large proportion of pectic acid; a considerable quantity of sulphur, and some chlorine and bromine, and another acid combined with lime, have been discovered,—the latter proves to be the oxalic acid.

Neither the fungic nor boletic nor lichenic acids could be detected, and the existence of iodine I have not been able as yet to detect. By extracting the pectic acid with caustic potassa, I found the moss taken up and altogether dissolved; and after treating the gelatinous mass with chloride of calcium, muriatic acid, and applying alcohol to separate the acid, at least 9-6 of this last was the result.

By reducing the moss to coal and dissolving it in water, sulphuretted hydrogen gas was evolved very abundantly; protoxide of iron, subcarbonate of potassa, diluted sulphuric acid, and lime water, gave copious precipitates.

The chemical characters of this moss are too interesting to be considered as completely determined by the few superficial experiments

* I am indebted to Dr. John Torrey, for the communication of the botanical description.

undertaken to discover its properties, especially as they were made at a time when I have been continually interrupted by an attention to the duties of my profession, and I consider them as having been undertaken more for the satisfaction of my curiosity, than as tending to a complete and scientific investigation of such an invaluable medical substance as carrageen, but I hope to be able very shortly to develope with more accuracy the entire composition of this singular moss.

The carrageen seems to possess qualities similar to the Iceland moss, which, according to Berzelius' last analysis, (a master-piece in every respect,) consists in 100 parts of 3·6 syrup, 1·9 bitartrate of potassa, tartrate and some phosphate of lime, 3·0 bitter principle, 1·6 green wax, 3·7 gum, 7·0 coloring matter, like extract, 44·6 lichen starch, 36·2 starch-like matter; but carrageen is without bitter principle, contains nothing but soluble matter, and the quantity of nutritious jelly produced by a small portion of it gives it the most indisputable preference. It was first introduced by Dr. Reece, who considered it a most important article of food for invalids, and Doctors Sulby, O'Reilly, and Sir Henry Halford, speak of the carrageen as the most nutritious article of food for delicate and weakly children. In this respect it is certainly superior to arrow root, sago, &c., being more highly nutritious, easy of digestion, and pleasing to the taste.

Prepared with warm milk and sweetened, it is most particularly recommended as a breakfast for consumptive patients.

Decoction of moss, made by boiling half an ounce clear moss in a pint and a half of water or milk until reduced to a pint, is recommended as food for children affected with scrofulous or rickety diseases, for such as are delicate and weakly, and for infants.

There are some printed directions for the manner of using the carrageen moss for medicinal and culinary purposes, accompanying some imported from England, from which I shall make here an extract.

Directions for using the Moss medicinally.—Steep a quarter of an ounce of moss in cold water for a few minutes—then withdraw it, (shaking the water out of each sprig,) and boil it in a quart of new or unskimmed milk, until it attains the consistence of warm jelly—strain and sweeten it to the taste with white sugar or honey, or, if convenient, with candied Eryngo root; should milk disagree with the stomach, the same portion of water may be used instead. The decoction made with milk is recommended for breakfast for consumptive patients; and with water will be found a most agreeable kind of nourishment, taken at intervals during the day, the flavor being varied with lemon-juice or peel, Seville orange juice, cinnamon, or wine of any sort most congenial to the taste.

The decoction in water is also taken for the relief of cough at any time in the course of the day, when it is troublesome, and it is for this purpose simply sweetened with honey.

In dysentery, the decoction, either in milk or water, may be administered with equal advantage, and in addition to the sweetening matter, if a tea-spoonful of the tincture of rhatany be mixed with each cupful of it, tone will thereby be given to the intestines, at the same time that nourishment will be conveyed to the system, and irritation prevented—a large tea-cupful of the decoction may be taken three or four times a day.

As a pleasant strengthening food, boiled with milk and strained, with the addition of a little sugar, it is unrivalled for infants. Persons take it in this way for breakfast or supper, with the happiest effect, who are sustaining an attack of the cholera.

Culinary Directions.—To make Blanche-Mange: take half an ounce of moss, and having cleansed it by the process above described, boil it in a pint and half new milk, until it is reduced to a proper thickness to retain its shape; to be sweetened and flavored with lemon, white wine, or any thing to suit the palate.

To make Orange, Lemon, or Savory Jellies: use a similar process, substituting water for milk—add lemon, orange, herbs, &c. according to taste.

To make White Soup: dissolve in water, afterwards add the usual ingredients.

It only remains to state, that the Carrageen, or Irish Moss, as a domestic article, is peculiarly interesting; it is the best thickener of milk, broths, &c., makes excellent jellies, and for Blanche-Mange is equal to most expensive ingredients, whilst the cost is comparatively nothing; it may be used instead of isinglass, jellies, &c.

13. *Oil of Copaiva as a test for the purity of the sulphuric ether.*—If ether is not fully deprived of water and alcohol, it forms when united with oil of copaiva an emulsion without dissolving it completely, whereas it is soluble when pure, in every proportion.

14. *Discharge of the stain of indelible ink, by corrosive sublimate.*—Dr. John Dickson, of South Carolina, in a letter to the editor, dated October 24, 1833, states that Mrs. Dickson had accidentally observed the discharge by corrosive sublimate from a handkerchief of the color produced by the nitrate of silver, and it was soon found that the same effect was produced upon linen, cotton, and the human skin. On the cloth* the stain partially re-appeared after washing, but on the skin it did not return.

The following circumstances led to Mrs. Dickson's observation: a weak solution of nitrate of silver, (warmly recommended in Eberle's Practice,) was used as a lotion in treating some cases of erysipelas; its power of producing a dark tint was well known to Dr. D., but as no caution is given in the above work, it was presumed that no such consequence would follow from using so weak a solution: but Dr. D. had the mortification to find the effect produced, and a solution of corrosive sublimate was then successfully applied to remove the stain produced by nitrate of silver. The following suggestions are made by Dr. D.:

* It is not specified what cloth is intended, but it is presumed that it is the fibre of the linen and cotton.

1. Not to use the nitrate on the face at all, especially in the case of females.

2. To take care that the solution reach only the portions of the surface that are in a state of erysipelatous inflammation, since there is reason to believe that it is less likely to stain the inflamed part, and, at any rate, vesication, desquamation, or absorption will soon remove the skin and stain together in the diseased surface, while this will not happen so soon in the healthy portion. Of course this is not of so much importance in parts habitually covered by the dress.

3. To have the parts to which the nitrate is applied protected from the light during the use of it.

4. To wash away the solution before it dries in the least from the fingers, &c. dipped in it in making the application. This may be done in common clean water, and if not effectually done in that, it may be certainly done in a weak solution of corrosive sublimate, as appears from our experience.

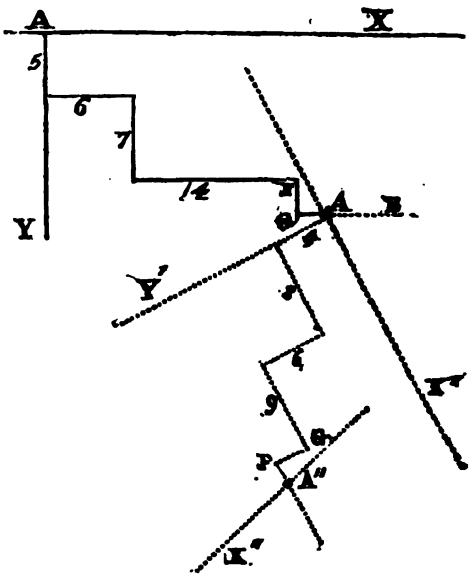
On the Location of Railroad Curvatures; being an Investigation of all the Principal Formulas which are required for Field Operations, in laying Curves and Tangent Lines, to pass through Given Points. By J. S. Van De Graaff. [From the American Railroad Journal.]

(Continued from page 206.)

In a long curve it cannot be expected, in consequence of little inaccuracies which are unavoidable in chaining, deflecting, &c., that the stations will be found, when they come to be actually traced, to agree *exactly* with the point obtained for an integer chain, by the system of co-ordinate axes; but the difference will not be such as to produce any sensible derangement in subsequent parts of the curve. And it may be observed that the point $\left\{\begin{array}{l} x=a+b+c+h \\ y=d+e+f+h \end{array}\right\}$, which was selected only for the sake of convenience in having the change of curvature to occur at the extremity of a *full chain*, when the whole line comes to be ultimately traced with the proper curvatures, will be situated within the nearest full chain of the given point $\left\{\begin{array}{l} X=a+b+c \\ Y=d+e+f \end{array}\right\}$; and the same curve which meets the former point will also *pass through* the latter, if n be the nearest integer number *greater* than N.

The following example will more fully explain the principles contained in the present article. Let AX be a given tangent line, and A the given origin of a certain curve which is required to be laid in such a manner as to pass through the two points F and G, whose positions are given. [See following figure.]

Take the lines indicated by the figures 5, 6, 7, and 14, to represent a system of rectangular lines, traced from the primitive origin at A, to the *first designated point* F; and let those figures indicate the length of each line respectively in chains, as determined by measurement in the field. The equations for the point F



will then be, $\left\{\begin{array}{l} X=6+14 \\ Y=5+7 \end{array}\right\}$; that is, $X=20$ and $Y=12$; and therefore by (XV.) Cot. $\frac{1}{2}D''=\frac{20}{12}=1.66667$; or, $\frac{1}{2}D''=30°\ 58'$; or, $D''=61°\ 56'$. And again by (XV.) Sin. $T=\frac{\text{Sin. } 61°\ 56'}{40}=\frac{.88240}{40}=.02206$; or, $T=1°\ 16'$, which is the modulus of curvature necessary to trace a curve from the origin at A, passing through the first given point F. And now to determine whether the point F will coincide with an integer number of chains, in the curve, from the origin A, we have by (XVI.),

$$N=\frac{61°\ 56'}{2°\ 32'}=\frac{61.93}{2.53}=24.48;$$

which is not an integer number. The point F, therefore, does not correspond to an integer number of chains in the curve; and a new point, A', must in consequence be found, which will coincide with the extremity of the 25th chain *in the same curve*. We then have $n=25$, $T=1°\ 16'$; or, $2nT=63°\ 20'$; and by (VII.)

$$x=\frac{\text{Sin. } 63°\ 20'}{2\text{ Sin. } 1°16'}=\frac{.89363}{.04422}=20.21 \text{ chains, } y=\frac{1-\text{Cos. } 63°20'}{2\text{ Sin. } 1°16'}=\frac{.55120}{.04422}=12.47 \text{ chains.}$$

Hence $h=x-X=+0.21$, and $k=y-Y=+0.47$. Let, therefore, the two rectangular lines FQ, and QA be traced in a manner similar to the former, and equal to .47 and .21 of a chain respectively, taking care to preserve their directions by references more remote; and a new station A' will be thus obtained, coinciding with the extremity of the 25th chain in the same curve, which passes from the primitive origin at A through the first given point F. The instrument may now be placed at A', and directed into the line A'B, parallel to the primi-

tive tangent AX; and because $2nT = 63° 20'$, therefore, agreeably to (IV.), deflect the angle $BA'X' = 63° 20'$, and the instrument will then indicate the true direction A'X', which is *tangent at the station* A', to the curve subsequently to be traced from the primitive origin at A.

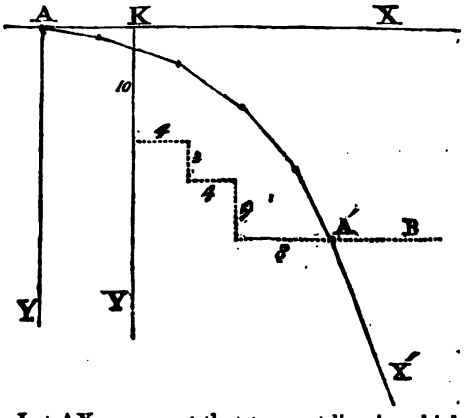
Now, take A'X' and A'Y', for a new system of rectangular co-ordinate axes, agreeably to which let a second system of rectangular lines be traced from the new origin at A', and terminating in the *second given point* G, and indicated in chains by the figures 4, 8, 6, 9, respectively, as before. The equations for the point G will then be $\left\{\begin{matrix} X = 8 + 9 \\ Y = 4 + 6 \end{matrix}\right\}$; that is, $X = 17$, and $Y = 10$; and therefore by (XV.) Cot. $\frac{1}{2}D'' = \frac{17}{10} = 1.70000$; or, $\frac{1}{2}D'' = 30° 28'$; or, $D'' = 60° 56'$. And again by (XV.), Sin. $T = \frac{\text{Sin. } 60° 56'}{34} = \frac{.87406}{34} = .02571$; or $T = 1° 28'$, which is the modulus of curvature necessary to trace a curve from the new origin at A', passing through the second given point G. And now to determine whether the point G will coincide with an integer number of chains in the curve, from the new origin at A', we have by (XVI.), $N = \frac{60° 56'}{2° 56'} = \frac{60.93}{2.93} = 20.80$; which is not an integer number. The point G, therefore, does not correspond to an integer number of chains in the curve; and a new point, A", must in consequence be found, which will coincide with the extremity of the 21st chain, *in the same curve*. We then have, $n = 21$, $T = 1° 28'$: or, $2nT = 61° 36'$; and by (VII.), $x = \frac{\text{Sin. } 61° 36'}{2 \text{ Sin. } 1° 28'} = \frac{.87965}{.05120} = 17.18$ chains,

$$y = \frac{1 - \cos. 61° 36'}{2 \text{ sin. } 1° 36'} = \frac{.52438}{.05120} = 10.26 \text{ chains.}$$

Hence, $h = x - X = +0.18$, and $k = y - Y = +0.24$. Let, therefore, the two rectangular lines GP and PA" be traced in a manner similar to the former, and equal to .24 and .18 of a chain respectively; and a new station, A", will be thus obtained, coinciding with the extremity of the 21st chain in the same curve which passes from the new origin A', through the second given point G. The instrument may now be placed at A", and directed into the line A"D, parallel to the first new tangent A'X'; and because $2nT = 61° 36'$, therefore, agreeably to (IV.), deflect the angle $DA''X'' = 61° 36'$, and the instrument will then indicate the true direction A"X", which is *tangent at the station* A", to the curve subsequently to be traced from its proper origin at A'.

The calculations of the two cases in this example have been *made out in full*, and expressed verbatim, with the exception only of such words as were peculiar to each case, in order that the principle might be at once comprehended by *all*; for it constitutes one of the most important *systems of operations* connected with the subject of curvatures, when properly understood and skilfully managed.

18. It is proposed to determine the modulus of curvature which will trace a curve from a given tangent line, and from a given *point therein*, in such a manner as to touch another right line given in position.



Let AX represent that tangent line in which the origin of the required curve is *unknown*, and A'X' that in which the origin of the curve is given at the point A'. Select any arbitrary point K, in the *former* tangent line AX, for the origin of a system of rectangular co-ordinate axes KX, KY: and parallel respectively to those axes let a system of rectangular lines be traced from the origin of the co-ordinates at K, and terminating at that *origin of the curve* which is given in the other tangent line A'X' at the point A'; and by means of those rectangular lines let the angle BA'X' be *measured*, and denoted by D, and which will express the inclination of the two given tangents AX and A'X' to each other. Take the equations

$$\left\{\begin{matrix} X = a + b + c + \&c. \\ Y = d + e + f + \&c. \end{matrix}\right\},$$

as *given* by means of those rectangular lines, and explained in the preceding articles. It is then very evident that the value of the ordinate Y, as thus determined, will not, in any manner whatever, depend upon the point which was selected in the tangent line AX, for the *origin of the co-ordinates;* and consequently that value of Y will express the true ordinate which corresponds with the given point A' in the required curve, as estimated from that *origin of the curve*, which is required to be situated somewhere in the given tangent line AX. And it hence follows from (VII.), that, $Y = \frac{1 - \text{Cos. } 2nT}{2 \text{ Sin. } T}$. But, $D = 2nT$, as appears from (IV.); and this value being substituted in the expression for Y, the following formula will result:

$$\text{Sin. } T = \frac{1 - \text{Cos. } D}{2Y}. \qquad \text{(XVII.)}$$

And thus the modulus of curvature of the required curve may be easily computed after tracing a system of rectangular lines

$$\left\{\begin{matrix} X = a + b + c + \&c. \\ Y = d + e + f + \&c. \end{matrix}\right\}.$$

But that origin of the required curve, which is

situated somewhere in the given tangent line AX, will also in some cases be wanted. Let that origin be at A, and put $\propto$ = AK; and then X = $\propto$, and Y will evidently be the co-ordinates of the point A′, as estimated from the origin A, and axes AX, AY. Hence, by (XIII.) Cot. $\frac{1}{2}$D = $\frac{X = \propto}{Y}$; or, eliminating $\propto$; the result is,

$$\propto = Y \times \text{Cot. } \tfrac{1}{2}D.—X. \quad \text{(XVIII.)}$$

Which makes the required origin known; but in using this formula, it must be observed that the hypothesis here assumed is, that $\propto$ is considered *positive* when it is measured immediately *opposite* to the direction of X from the selected origin of the given co-ordinates X and Y; and consequently, when $\propto$ comes out *negative* from (XVIII.), it must be taken in a direction *coinciding* with X.

Example. Let a system of rectangular lines be traced in a manner similar to those represented upon the figure by the figures 10, 4, 3, &c.; and let those figures denote the length of each line in chains. The angle BA′X′ being measured, let it be found = 60°.

In this case, then, $\left\{\begin{matrix} X = 4+4+8 \\ Y = 10+3+5 \end{matrix}\right\}$; that is, X = 16, and Y = 18. And,

$$\text{Sin. T} = \frac{1 - \text{Cos. } 60°}{36} = \frac{.5000}{36} = .01390;$$

from which is found T = 0° 48′ = modulus of curvature of the required curve. To find the position of the origin A, we have $\propto$ = 18 × Cot. 30° — 16 = 18 × 1.732 — 16 = 31.18 — 16 = + 15.18. Hence measure 15.18 chains from the selected point K, and *backward* as regards the axis KX, of X. The required point A will be then obtained; from which a curve being traced by means of the modulus of curvature 0° 48′, it will meet the given point A′, and come into the given tangent line A′X′. Or, vice versa, being traced from the given point A′ and from the given tangent line A′X′, it will *touch* the other given right line AX at the point A.

It frequently happens, in tracing curves for the superstructure of a railroad upon a graded surface, that AX will represent a *fixed* tangent, and that the point A′ will represent a station in a curve which is also *fixed*, and to which A′X′ is a tangent at that point; and it is then required to pass that curve into the curve AA′ at the station A′ and upon the *common* tangent A′X′. In such a case it will always be the best method, after the necessary modulus of curvature has been computed by means of (XVII.), to trace the curve from A′ towards the other origin at A. For then the two curves will meet at A′ with an integer chain; and the broken chain will come in more conveniently, at the other extremity of the curve, where it meets the given tangent line AX.

The formulas (XVII.) and (XVIII.) will also, in some cases, be highly useful in conducting the location of a line with facility. Suppose, for example, that AX be a given tangent line, whose direction is fixed by some former curve, and particular local circumstances; and let the line A′X′ represent the direction of some bluff, or other obstacle, which makes it desirable for that part of the contemplated road to occupy ground which will correspond with the line A′X′, or differ from it as little as circumstances will permit. In this case, then, having selected any convenient point K, in the given tangent line AX, for the origin of co-ordinate axes, let the system of rectangular lines, $\left\{\begin{matrix} X = a+b+c+\text{&c.} \\ Y = d+e+f+\text{&c.} \end{matrix}\right\}$, be traced from that origin, and terminating in such a point A′ as the nature of the ground *and the levels* may require. Then placing the instrument at A′, deflect into the proper direction A′X′, and thus measure the angle BA′X′. Having then all the requisite data for computing the origin A, and the necessary modulus of curvature, to pass a curve through the point A′ and into the direction A′X′, let those items be calculated. It will then be seen, at once, whether the point A′, and the direction A′X′, can both be maintained within the limits of the desired expense and curvatures; and if not, then either some other point A′ must be taken, or some new direction must be assumed. These facts should be always ascertained, and the most judicious line definitely selected, *before any curve is actually traced.* It is, however, necessary to observe here, that, in the location of a line preparatory to the graduation, it will be very seldom proper to trace a curve backward from any selected point A′ to meet the line upon a given tangent AX, as was recommended in the case of a graded surface. For in the first location, integer chains should be always retained when practicable; and which cannot be easily done without tracing the curves and tangent lines continuously. In the case, then, last considered, the following principles should be observed: After the point A′ and the direction A′X′ have been finally selected, and the requisite origin A, together with the modulus of curvature for the required curve, have been already calculated, if that origin does not fall upon the tangent line AX at an integer chain, then select the nearest integer chain for the true origin; and compute a *new modulus of curvature*, which will pass a curve from that latter origin through the designated point A′. It is then very evident that the direction of this curve, in passing the point A′, will differ but little from the direction of the former curve at the same point. When therefore the curve, as last selected, has been laid within one or two chains of the designated point A′, let such a variation be made in the modulus of curvature, for the remaining chain or two, as will restore the *parallelism* of the two tangents, agreeably to principles which will be obvious enough from (V.) In this manner the true direction will be obtained; and although the line will not then pass exactly through the designated point A′, yet it will not vary a material distance from it.

When this system of operation is to be pursued, it will always be convenient, in selecting the arbitrary point K, to take it at an integer chain, counting from the termination of the line as actually laid into the given tangent AX; and

then if $\propto$ does not appear from (XVIII.) to be an integer number of chains, select the nearest integer number to it, and the co-ordinates by which to compute the *new modulus of curvature*, from (XII.) will evidently be $X \pm \propto$, and Y, regard being had to the proper sign of $\propto$, as already explained.

19. Although a system of rectangular lines, traced from given co-ordinate axes, will in general furnish the best data for computation, yet cases sometimes occur when those calculations have to be made from computed curves or curves already laid upon the ground. In a first location, this case will sometimes happen, when, from difficulties which are found in advance of a line, it becomes necessary to change a part of that which was either already computed, or actually laid. Such a case will sometimes occur even when the operations in the field have been skillfully conducted; and in laying curves upon a surface already graded, it will be frequently necessary to compute from curves actually traced; for in that case it will be often required to notice the particular situations of several stations in a curve or tangent line, and which cannot be so readily done in any other manner as by actually laying an approximate line upon the ground. The *notes* of those approximate lines are, moreover, in such cases, *always furnished* from a former survey.

20. Suppose two curves to be laid upon the same tangent line, and let $\propto$ denote the distance between their origins. Let one of those curves have a given modulus of curvature denoted by T, and let it pass through a certain given point at the extremity of the nth chain. It is then proposed to find the modulus of curvature of the other curve, such that it may also pass through the same given point; and it is likewise required to determine the angle of intersection of the two curves at that point.

The co-ordinates of the given point, taken with reference to the origin of the required curve, are obviously $x \pm \propto$ and y; and consequently, taking T′ to denote the required modulus of curvature, its value will be expressed by

$$\text{Sin. } T' = \frac{y}{x^2 + y^2 \pm 2\propto x + \propto^2}, \text{ as appears from}$$

(XII.) Hence, substituting in this expression, for x and y, their values* as obtained by (VII.), the following theorem will be the obvious result:

$$\text{Sin. } T' = \frac{1 - \text{Cos. } 2nT}{\frac{1 \text{ Cos. } 2nT}{\text{Sin. } T} \pm 2\propto . \text{Sin. } 2nT + 2\propto^2 . \text{Sin. } T}. \quad \text{(XIX.)}$$

* *Note.*—By squaring each of the two formulas given by (VII.), and adding the two squares together, the following expression will result after a little reduction:

$$x^2 + y^2 = \frac{1 - \text{Cos. } 2nT}{2 \text{ Sin. }^2 T}.$$

This is, however, not the form which a formula should have for computing the numerical value of $x^2 + y^2$; but it is useful in reducing other formulas.

The formula thus obtained will be found to be quite convenient for purposes in the field, when the curves are too long to be within the limits of the more simple approximating methods, which will be hereafter explained.

With regard to the double sign, it must be observed that the *negative value of* $\propto$ obtains when the origin of the curve sought is in *advance* of the origin of the given curve, with respect to the direction in which the curves are laid from their origins; and the *positive* value must be taken in the contrary case.

In order to determine the angle of intersection of the two curves, take D′ to denote the number of degrees and minutes contained in the curve whose modulus of curvature is T′, between its origin and the given point, and which will, consequently, by (I.) and (IV.) also express the inclination of the required curve, at that point, to the *common tangent* at the origins. The value of D′ will then be expressed by

$$\text{Cot. } \tfrac{1}{2}D = \frac{x \pm \propto}{y},$$

as appears from (XIII.) Now, substituting in this expression for x and y, their values as given by (VII.), the following formula will be the result:

$$\text{Cot. } \tfrac{1}{2}D' = \text{Cot. } nT \pm 2\propto . \frac{\text{Sin. T}}{1 - \text{Cos. } 2nT}. \quad \text{(XX.)}$$

The value of D′ being thus obtained, the required angle of intersection will be expressed by $2nT - D'$; as evidently appears from (V.)

Example 1. Let the modulus of curvature of the given curve be 30′, and let the given point be at the extremity of the 60th chain. Supposing the origin of the other curve to be placed 10 chains *back* upon the tangent line, what will be the new modulus of curvature, and what will be the angle of intersection at the given point?

In this case,

$$\text{Sin. } T' = \frac{.50000}{\frac{.50000}{.00873} + 20 \times .86603 + 200 \times .00873}$$

$$= \frac{.50000}{57.299 + 17.321 + 1.746} = \frac{.50000}{76.366} = .00655;$$

and consequently, T′ = 0° 22½′ = required modulus of curvature. And, Cot. ½D′ = 1.73205

$$+ 20 \times \frac{.00873}{.50000} = 1.73205 + 20 \times .01746 = 1.73205$$

+ .34920 = 2.08125; and therefore, ½D′ = 25° 40′; or, D′ = 51° 20′. Hence, 2nT − D′ = 60° − 51° 20′ = 8° 40′ =, the angle of intersection required.

Example 2. Let the modulus of curvature of the given curve be 2°, and let the given point be at the extremity of the 31st chain. Supposing the new curve to be commenced one chain in *advance* upon the tangent line, what will be the required modulus of curvature, and what will be the angle of intersection at the given point?

Here, T = 2°, and $n = 31$; and consequently 2nT = 124°. Hence, in this case, Cos. 2nT

becomes *negative*, while Sin. $2nT$ remains positive, agreeably to the principles of trigonometry. Also, in the present example, $\propto = -1$. Under those considerations, the formula (XIX.) gives,

$$\text{Sin. } T' = \frac{1 + \text{Cos. } 56^\circ}{\frac{1 + \text{Cos. } 56^\circ}{\text{Sin. } 2^\circ} - 2\,\text{Sin. } 56^\circ + 2\,\text{Sin. } 2^\circ}$$

$$= \frac{1.55919}{\frac{1.55919}{.03490} - 2 \times .82904 + 2 \times .03490} =$$

$$\frac{1.55919}{44.676 - 1.685 + .070} = \frac{1.55919}{42.788} = .03643\text{; or,}$$

$T' = 2^\circ\ 5\frac{1}{4}' =$ required modulus of curvature. In obtaining the value of the angle D′ by means of (XX.), the necessary sign of the trigonometrical quantities must in like manner be observed; and consequently, Cot. $\frac{1}{2}D' =$ Cot. 62°

$$- 2 \times \frac{\text{Sin } 2^\circ}{1 + \text{Cos. } 56^\circ} = .53171 - 2 \times \frac{.03490}{1.55919} =$$

$.53171 - 2 \times .02239 = .53171 - 04478 = .48693$; or $\frac{1}{2}D' = 64^\circ\ 2'$; and, $D' = 128^\circ\ 4'$. Hence, $D' - 2nT = 4^\circ\ 4'$, the angle of intersection required.

In computing the modulus of curvature for a long curve, which is required to be laid with precision, it will not be sufficient to obtain a result only true to the nearest *full minute*. For in tracing a curve agreeably to the principles given in Art. 3, it is evident that multiples of the modulus of curvature are required in laying the different chains; and consequently, an error of $\frac{1}{4}'$ in the modulus of curvature would produce an error of 2′ in the angle of deflection, placing the 8th chain from the instrument. Now, in any common instrument, containing a good vernier scale, an angle of 2′ is quite perceptible. Indeed, if the chains be 100 feet each, an angle of 2′ will be subtended by a line nearly 6 inches long at a distance of 8 chains; and it follows, therefore, that an error of *one fourth part of a minute*, in the modulus of curvature, will, in such a case, produce an error of nearly 6 inches in the position of every 8th station from the instrument. And as the effects of this error will not continue to be only proportionably greater through the whole line, but will accumulate faster and faster, in a geometrical ratio, it is evident that an error of $\frac{1}{4}'$ in the modulus of curvature is an item of considerable consequence in laying long curves upon a graded surface.

21. If the point designated for the required curve to meet does not coincide with the extremity of the nth chain in the given curve, as in the last article it is supposed, but varies a small distance to the right or left, yet, *if the curves are long*, the best method will always be to compute the value of T′ as though the curve sought were intended to pass through the point contemplated in (XIX.); and then the requisite small variation in the computed value of T′, to meet the case proposed, may be subsequently determined by very simple methods, to be hereafter explained.

[From the Charleston Courier.]

LIFE'S LIKENESS.

Written in imitation of the poetry of the 17th century.

Life is—what?
It is the shooting of a star,
That gleams along the trackless air,
And vanishes, almost ere seen, to nought:
And such is man—
He shines and flutters for a span,
And is forgot.

Life is—what?
It is the vermeil of the rose,
That blooms but till the bleak wind blows,
Then all entombed, in sweets, doth fade and rot:
And such is man—
He starts in bravery for a span,
And is forgot.

Life is—what?
It is the dew drop of the morn,
That quiv'ring hangs upon the thorn,
'Till, quaff'd by sun-beams, 'tis no longer sought:
And such is man—
He's steel'd in for a span,
And melts, forgot.

Life is—what?
A stone, whose fall doth circles make
On the smooth surface of the lake,
Which spread till one and all forsake the spot:
And such is man—
'Midst friends he revels for a span,
And sinks, forgot.

Life is—what?
It is a bubble on the morn,
Rais'd by a *little globe* of rain,
Whose heir destroys the fabric it hath wrought:
And such is man—
Swell'd into being for a span.
And broke, forgot.

Life is—what?
A shadow on the mountain's side,
A rock that doth in either ride,
Driven by the northern gale, with tempest fraught:
And such is man—
He hangs on greatness for a span,
And is forgot.

Life is—what?
It is the sound of cannon near,
Which strikes upon the startled ear,
And ceases ere we can distinguish aught:
And such is man—
He frights and blusters for a span,
And is forgot.

Life is—what?
It is the swallow's sojourment,
Who, ere the summer's robe is rent,
Flies to some distant bourne, by instinct taught:
And such is man—
He rents his dwelling for a span,
And flits forgot.

And is this—life?
Oh yes! and had I time I'd tell
An hundred shapes more transient still—
But whilst I speak, Fate whets his slaughterous knife:
And such is man—
While reck'ning o'er life's little span,
Death ends the strife.

THE *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. MINOR and J. E. CHALLIS, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum, *in advance*.—JOHN KNIGHT, (formerly proprietor of the London Mechanics' Magazine,) Editor.

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING NOVEMBER 22, 1834. [NUMBER 5.

Application of Caoutchouc, or Indian Rubber, to Ropes used on Railroads, &c.

It is with great pleasure that we insert the following from our esteemed friend, and we solicit the attention of all who are engaged in the construction of railroads to its contents.

We have no room at present for remarks, but shall recur shortly to the subject; in the mean time, shall be happy to learn the opinion of some of our scientific correspondents.—[ED. M. M.]

To the Editor of the Mechanics' Magazine:

My dear Sir,—Agreeably to your request, I now give you the particulars of my patent for the application of caoutchouc, or Indian rubber, in solution, to ropes used on the inclined planes of railroads, and shafts of mines.

My specification states that the ropes as now used on the inclined planes of railroads, by being exposed to the weather, are liable to decay and become rotten, as well as to great expansion and contraction, and that I propose to prevent such decay and variation in length, by covering said ropes, or the separate strands of which such ropes are composed, before being spun into ropes, or when so spun, but before being used, with caoutchouc, or India rubber, dissolved in the purified naptha of coal tar, in Barbadoes tar, in petroleum, in sulphuric ether, in spirits of turpentine, or in such other substance as possesses the power or property of dissolving caoutchouc or India rubber, and permitting it to dry into its hard state without being clammy.

In announcing my improvement to the public, through the medium of your valuable Magazine, I trust to your kindness to offer such remarks on its utility to parties interested in railroads with inclined planes already made, as well as those now making, that, by its adoption, an immense annual expenditure for ropes would be saved, and the dread of their breaking entirely done away with, thereby affording perfect security to passengers in passing inclined planes. Even the knowledge and conviction of that security may be the cause of constructing railroads with inclined planes in mountainous districts, where, without it, it would be looked on as impracticable.

Your's, truly,

PATRICK MACKIE, M. D.

29th October, 1834.

All communications may be addressed to you, or to your humble servant at the Albany Hotel, No. 31 Courtlandt st., New-York.

Influence of the Moon on the Weather; Substance of a Paper read at the Natural History Society of Geneva, in October, 1833, by F. MARCET.

On the question whether the moon has any influence over the weather or not, there are two opposite opinions; the great mass of the people, including sailors, boatmen, and most practical farmers, entertain no doubt whatever of the influence of the moon; whether the change of weather at the lunar phases will be from fair to foul, or from foul to fair, none of them pretend to decide beforehand, but most of them think, that at the new and full moon there is generally a change of some kind. On the other hand, philosophers, astronomers, and the learned in general, attribute this opinion altogether to popular prejudice. Finding no reason, in the nature of atmospheric tides, for believing that changes should take place on one day of the lunation rather than another, they consider the popular opinion to be unsupported by any extended series of correct observation.

In the Annuaire for 1833, Arago, the learned editor, has presented the result of the observations of Schubler, in Germany, during 28 years, or 348 synodic revolutions of the moon. During this period of 348 new moons, &c. the number of rainy days was as follows:

It rained on the day of the new moon 148 times.

Do.	do.	first quarter	156 "
Do.	do.	full moon	162 "
Do.	do.	last quarter	130 "

The observations of Schubler were made, during 8 years, at Munich, 4 years at Stuttgard, and 16 years at Augsburg.

As a good meteorological register has long been kept at Geneva, the author thought it would be interesting to ascertain from the ta-

bles, (which have been carefully published in the Bibliotheque of that city,) whether, during a period of 34 years, viz. from 1800 to 1833, any inferences could be drawn for or against the popular opinion on the subject of lunar influence. He finds, during these 34 years, the number of rainy days and the quantity of water fallen to be as follows:

	Rainy days.	Water fallen.
At the New moon,	123	432 lines.
First quarter,	122	429.6 "
Full moon,	132	415.7 "
Last quarter,	128	368.6 "
The whole period,	3,657	968 in. 9.3 "

Thus it appears, that during 34 years, or 12.419 days, comprehending 420 synodic revolutions of the moon, there have been 3,657 rainy days. This gives, for every 100 days, 29.45 rainy days, and we find, that for every 100 days of new moon, 29.29 have been rainy.
Do. do. first quarter, 29.05 do. do.
Do. do. full moon, 31.43 do. do.
Do. do. last quarter, 30.48 do. do.

Hence, it is evident, that during these 34 years at Geneva, the days of new moon and the days of the first quarter have been just about as liable to be rainy days as any other common day of the month, while the days of full moon and those of the last quarter have been *rather* more liable.

But although the days of full moon have been rather more frequently wet days than those of new moon, it does not follow that more water has fallen at full moon than at the change. The result of observation in that respect is as follows:

For every 100 days of new moon there fell 102.9 lines.
Do. do. first quarter, do. 102.3 "
Do. do. full moon, do. 90.0 "
Do. do. last quarter, do. 87.9 "

The average quantity for every 100 days is 93.6 lines, whence it appears, that at the new moon, the first quarter, and the full moon, more water has fallen than on common days; at the last quarter, less. The quantity fallen on the total of the lunar phases surpasses that on other days in the proportion of 98 to 93.6.

Another question is, whether a *change of weather* is more liable to happen on the four principal days of the lunar phases than on common days. But it must be decided what is meant by the term change of weather. This term should, the author thinks, be limited to a change from clear weather to rain, or from rain to clear weather, and not be understood to include, as some meteorologists make it, all changes, such as that from calm to windy, or from clear to cloudy, &c. As the author accepts it, the weather must have been steady during two days at least; that is, that the weather has been clear, or that it has rained more or less during two consecutive days. For example, a week has passed without rain; it rains on the eighth day; and on the ninth the weather is again fine. In this case, according to the author's definition, there is no change of weather. So, also, if it has rained during five successive days, the sixth and the seventh must be clear, in order to constitute a change of weather. This may be arbitrary, but at least it is not vague, and if practised it will prevent, in the balancing of calculations, any leaning to a favorite hypothesis. To avoid another error, into which some have fallen, the author marks no change as occurring on lunar phases but those which take place on the very day, and never those which may happen on the evening before or on the next day.

With these precautions he finds that during the 34 years, or 12,419 days, there have been 1458 changes of weather. Of this number, 105 have taken place at the epoch of the two principal lunar phases, viz., 54 at the new moon, and 51 at the full moon. Now the whole number of principal phases during the 34 years is 840, therefore,

As 12419 : 849 : : 1458 : 98.6, the number of changes which would have taken place at new and full moon, had these lunar phases had no more than the share of common days, but, instead of which, the number was 105.

Of the 54 changes at new moon, 32 were from rain to fine weather, and 22 from fine weather to rain. Of the 51 at full moon 31 were from rain to clear, and 20 from clear to rain. Thus at the new and full moon, the changes to fine weather are to those to rain as 63 to 42.

Having thus proved that the epoch of new and full moon is not absolutely without some effect on the weather, the author examined whether this effect was confined to those very days, or extended to the day following. On the days following the new and full moon, there were 129 changes, instead of 98.6, which would have been the number had these shared the proportion only of common days.

With respect to the days of the first and last quarter, the changes on these were 96, which bring them nearly to the condition of common days.

It is thus shown from the tables, that the chance of a change at new and full moon, compared with the chance on ordinary days, is as 125 to 117, and that the chance on the day following these two phases, compared with the common days, is as 154 to 117.

Upon the whole, therefore, this examination lends some support to the vulgar opinion of the influence of new and full moon, but none whatever to any especial influence of the first and third quarters.

With respect to *barometrical pressure*, it is ascertained that out of the 1458 changes of weather, there were in 1073 cases a corresponding rise or fall of the barometer, according as the change was from rain to fair, or the contrary. This is nearly as 3 to 4. Of the 385 false indications of the barometer, 182 were on a change from rain to clear, and 203 on a change from clear to rain. Finally, of the 385 anomalies of the barometer, 17 were at full moon, and 10 only at new moon.—[Bib. Univ. Feb. 1834.]

Length of Life in Comets.—It being clear that an atmosphere is necessary to vegetable and to animal life, and it being pretty clear, as I think, that every planet and every comet is surrounded by an atmosphere, and that every planet and every comet enjoys as much of an atmosphere, in all situations, as is sufficient to preserve a moderate temperature for all its inhabitants, we are bound to believe that as those globes are obviously fitted to be the habitation of rational creatures, they are certainly inhabited.

What ideas are we to form concerning the rank of the several inhabitants of those globes, in the scale of intellectual beings? On this subject we have only to observe, that if the length of their several lives, or the extent of their intellectual attainments, be at all proportioned to the length of their years, or the magnitude of the globes they inhabit, many of them might regard us with pity. The comets are of various sizes, and their years from seventy-five of ours to five or six hundred. The comet of 1744 was about twenty-seven times the bulk of this globe. The planet Jupiter, whose year is equal to twelve of our years, is more than six hundred times the bulk of this globe.

When we speak of comets wandering to the distance of twelve thousand millions of miles from the sun, it may be objected that, at such a distance, they would certainly interfere with some other systems. But we are to consider that it appears, from correct observations, that the nearest fixed star must be at a greater distance from us than four hundred thousand times ninety-four millions of miles, which is the distance of the sun from the earth. Thus it appears that a comet must travel at least sixteen hundred times the distance mentioned, before it could arrive at the central space between our sun and the nearest luminary of another system. It will follow, that light must be above two thousand two hundred days in coming from the nearest fixed star.

Having ventured an opinion that every planet and every comet in our system is inhabited, we have only taken a very imperfect view of the astonishing works of the divine Architect. There are about three thousand fixed stars visible to the naked eye. Every one of those stars is doubtless a sun, and each of those suns affords light and heat to another system of worlds. Let us only suppose that each of those suns illuminates as many orbs as belong to our system. We shall state the number at two hundred, though it is believed that twice this number of comets, besides the planets, have already been discovered. This would give three hundred thousand worlds. But three thousand is a small number, when compared with the whole number of stars that have been discovered. The relative places of fifty thousand stars have been determined, by the help of telescopes. Fifty thousand solar systems, each containing, at least, one hundred worlds. Five millions of worlds, all inhabited by rational beings. How do we seem to dwindle into littleness! How small, how few, are the ephemerons of this little globe, when compared with the countless myriads who inhabit five millions of worlds! All those worlds, and every one of their inhabitants, are under the constant care of the Divine Being. Not one of them is neglected. 'Great and marvellous' are his works. How terrible his power! ! — [Scientific Tracts.]

Tenacity of Life.—Edwards, a celebrated experimental physician of France, not long since deprived two Salamanders of their hearts, and then placed them in water of the same temperature, which had been deprived of air by boiling, and two others in air. One of the former died in eight hours, the other in nine, while those in the open air lived from twenty-four to twenty-six hours. By repetition the same results were presented, by which he infers that air, in comparison with water, has a superior vivifying influence upon the system of these animals, independently of its action by means of circulation and respiration.—[Ib.]

Important Invention.—We have just seen the model of a vessel, constructed on the principle of a steam packet, propelled by paddles, but, from its peculiar mechanism, it completely supersedes the necessity of steam. The given power is communicated by four revolving sails, (gigot shape,) placed over the centre of the boat, which are acted upon by the wind from any point whatever, without in the least interrupting the progress of the vessel. The serious consequences often arising from the effects of sudden squalls are hereby completely obviated, from the accelerated horizontal action which the sails acquired, one counteracting the weight of the other in a direct ratio. This invention will also be of infinite utility in the construction of mills used in every description of manufacture. In fact, we deem it one of the most important discoveries of modern times. The inventor, Mr. John Willis, of whose talent and genius we have often spoken, intends taking out a patent for the discovery.—[Wexford Independent.]

ANNIVERSARY ADDRESS

Delivered before the American Institute of the City of New-York, at the Chatham street Chapel, October 9th, 1834, during the Seventh Annual Fair, by the Honorable HENRY BALDWIN, *of Pennsylvania.*

MR. PRESIDENT, AND GENTLEMEN OF THE INSTITUTE:

Fairs are interesting as an exhibition of the products of human labor, in those arts which are alike indispensable to private comfort and national prosperity; the experience of all nations, who have held them, has through all time attested their good effects, in the incentives which public admiration never fails to excite in the artisan and mechanic, to renewed zeal, and to stretch every faculty of his mind and body to their utmost capacity in the fabrication of what gives pleasure to every one, and profit to himself.

The premiums distributed are, to the successful competitor, the public testimonials that he has made some useful contribution to the common stock worthy of the token of public gratitude, earned by his labor and skill.

The effects of a display and public exhibition of the various specimens of the articles of consumption, in the wide circle of society, promotes that competition between the fabricator and seller which never fails to benefit the consumer and purchaser.

To the young mechanic, who desires to avail himself of improvements in the practical sciences, or mechanical arts, they are the sources of profit and instruction, in taking from the labor of others, to his own appropriate occupation, the means of usefulness to the public and his own interest.

Mere spectators admire them as a splendid pageant, which captivates the eye by the brilliant effect of an exhibition in one view of the numerous and choicest productions of the useful and ornamental arts; presenting in the aggregate a condensed display of the fruits of the native industry and skill of our countrymen and women, at the fireside, in the workshop, or the manufactory; exemplifying the wants of society, with their means of supply from domestic sources.

They view with equal admiration its component items in detail, whether formed by the hands of the man, the child, or the woman, by the machinery of a cambric needle, or the mighty power of the steam engine, conducted by the science of the engineer and the labor of the hardy fireman; the materials of its composition, the skill with which they have been fabricated, the combined effect of both, in beauty of appearance, and substantial value for utility or ornament, equally strike the view, and impress the mind with pleasure.

Fairs are also the practical illustrations of the operations of government, the nature of its institutions, and the course of legislation upon those interests which have been the favored objects of its guardianship; testing their adaptation to the products of the soil, and the inclination of the people, in the results of labor and the material afforded.

They are also epochs which denote the state of the arts, and the nation, at the different periods of its history; affording authentic historical facts recorded in its annals, handed down by tradition, or evidenced by some relic of former times, preserved to show how their ancestors lived, and the relative condition of the country during the lapse of time.

And as every nation in the civilized world has some rival in the arts, in institutions of government, and systems of policy, each is emulous to excel the other, and to make the most favorable display of its resources, so as to impress upon all who witness them their wisdom and successful results. All these considerations combine to give to the fairs and exhibitions of the products of labor and skill a high degree of interest, pleasure, and utility. But in this country, fairs like the one we have witnessed are calculated to inspire the mind with higher and stronger emotions. This exhibition of the varied productions of native industry is not merely the developement of the gradual progress of an infant nation, in those arts which alike contribute to the increase of private happiness, and the expansion of all the sources of national greatness.

It is more like the unfoldings of a new creation, which open to the vision with doubts of their reality, and burst upon the mind with all the charms of an enchanted scene. If we trusted to the dictates of reason, alone, and founded our judgment on what appeared to be the accustomed order of improvement in other countries, we should credit no man's assertion that many of the proudest specimens displayed were the products of arts introduced among us as but of yesterday.

And if there could be a Fair, which would cease to be impressive by its brilliancy as a pageant, and to interest the spectators by the quality of the articles which compose it, as a display of merchandise for sale or exchange, it is the one which the labors of the Institute have presented to our examination. Its zest is as a moral spectacle in the visible tangible evidence of the capacity of the country to fabricate all the articles of necessity and comfort requisite to the supply of the wants of the people, and many of the enjoyments of luxury; it testifies to the senses and the understanding, that in our internal resources are found the materials, and in the skill, ingenuity, and industry of our citizens, the abundant assurance, of their ability to meet all the requisitions of society from domestic sources, without imposing any burthen on the pursuits or interest of any of its members.

It is on a small scale what the country is on a great one; the whole nation is one expanded fair, in every part of which are exhibited the specimens of the mechanical arts and manufacturing skill, and their salutary fruits. There is no part, however remote, that does not profit by the invention of the cotton gin; and the improved application of steam power, more than it, contributes to the support of government.

The whole revenue from impost does not equal the annual saving in the production and transportation of the crops of the south and west, and the expenses of travelling consequent upon these improvements; and no American, who in the Fairs of Europe has examined the specimens of the arts of the country which they have exhibited, will be humbled in any one feeling of national pride, in viewing the Fairs of the American Institute. What has been seen abroad is the improvement of ages upon established arts; what is seen here is the creation of a few years; and even if he should award the premium to the foreign article, the wonder is not that there should be a difference, but that there should be a competition.

If we look at these things with American feelings, they excite the swelling emotions of patriotism at what we have attained, rather than humiliation at the space we have left between the attainments of the different countries of Europe and our own; the indications of the last thirty years justify the confident belief that in the next we shall be as far in advance of the old world, in every branch of industry, which makes a nation great, and the people happy, as we have been behind them even in our infancy.

It must be remembered that it is not sixty years since the people of this country composed thirteen colonies, which had no political connection with each other, or any bond of union but their common dependence upon the crown of Great Britain; that it is not fifty years since the first institution of a government, which had the physical power to promote the progress of the useful arts, to encourage manufactures, or to protect either from the long settled policy of other governments, and only ten years since the powers of the government have been exerted in the adoption of any great system of protecting policy.

This Fair and the condition of the country are the commentaries on the American system, which has enabled man to avail himself of the bounties of Providence, under the protection of a government which secures from foreign invasion the fruits of the labor of those who sustain it, in the adoption of a system of policy which fulfils all the objects of its institution.

It is under its auspices that the healing effects of a free government are exemplified, that its resources are developed, and its independence consummated. We were always a free people; we became an independent people by the valor of the heroes, and wisdom of the patriots, of the revolution; but neither freedom nor independence made us a happy or a great people.

This remained to be done by the successful pursuits of agriculture, the arts, manufactures, and commerce; the farmer, the mechanic, and the merchant, have made us a great nation by the combined results of production, fabrication, and distribution, from their humblest beginnings to the greatest perfection which science, industry, and the arts, can give them.

The nation has its anniversary, and parties their days of celebrating political triumphs; and why may not mechanics have their jubilee? and why may not any man in the nation, be his station what it may, join in the triumph and partake the gala.

Public opinion justly excludes the incumbent of a judicial office from all those assemblies into which political excitement enters; but it would be hard indeed, if, when one meets with his associates of other days, with whom he has acted in a great and common cause in all the harmony of private confidence, and under a common impulse to promote the public good, and now sees in the happiness of all around them, and the boundless extent of the healing and blessings of a system which protects the whole industry of the country, it should not be permitted to him to hold a public conference with those friends and associates in the public and private efforts which led to its adoption. I cannot look upon the old

members of the Mercantile Society of New-York, and of the present Institute, without recollections which I am sure they indulge with as much pleasure as myself, nor contemplate the Fair which they have prepared, without referring to that system of which it is the legitimate and acknowledged offspring, and the part which individually and attentively they acted in trying times.

It is at the mechanics' jubilee that their importance to society is estimated, and the mighty effects of their industry are displayed; it is here that they can show their victory over foreign policy, and that in fighting the battles of the producer and consumer, they have achieved a moral triumph, harmless to friends, country, or any of its interests; and after a few more such exhibitions of mechanical and manufacturing skill, poetry and public opinion will alike declare,

> "That the warrior's name,
> Tho' pealed and chimed on all the tongues of fame,
> Sounds less harmonious to the grateful mind
> Than his who fashions and improves mankind."

It is many years since you associated for the furtherance of a great cause, which you deemed of vital importance to the welfare of the whole community; it was during that period of gloom and despondency which overshadowed the land after the late war, that you formed a voluntary society for the promotion of American industry, and its encouragement in all its great branches. You advocated a system of national policy which would revive the commerce and protect the navigation of the country, by the same measures which should sustain the existing manufacturing establishments, and give to new ones an assurance that they should not remain exposed to prostration by foreign policy, regulations, or laws.

Your conduct was not regulated by any fears that the prosperity of any branch of national industry would injuriously affect any other; in calling on the National Legislature to rescue the commerce, the navigation, and the manufactures of the country, from the spirit, the commercial policy of other nations, which had enabled the merchant, the ship owner, and manufacturer, abroad, to seize and retain the fabrication and distribution of the articles of consumption. You disavowed the belief, that the theatre which was open for the display of industry, was large enough only for two of its great pursuits. You declared that the merchant and the farmer ought to make common cause with the mechanic and the manufacturer; that the field of their operations was the whole Union, in which each could be successful, not only without impairing the profits of the other, but with the certainty of mutual benefits, if the government would act in the common cause. You did not yield to the too prevalent apprehension that the state of the country was not adapted to the policy of protecting manufactures by legislation; that it would tend to destroy the revenue, commerce, agriculture, and morals of the nation, or operate as a tax on all for the emolument of the few. You went farther: as members of the Mercantile Society, you expressed an opinion, and made an assertion, in relation to the consequences of the adoption of a protective system, which proposed to embrace within its provisions all the leading articles of manufacturing industry, to the supply of which the capacity of the country was deemed fully adequate, that cannot be unnoticed on this occasion. (See Appendix, A.) After having, during the operation of the then existing system, for five years examined its practical results on the interests of the country, it was your deliberate opinion, that where the domestic article has superseded the foreign in our market, the consumer is supplied with a better article at the same price, and that the prohibitory duties on East India cottons of the coarsest description had benefitted commerce by giving increased employment to shipping. You also stated that the price of those manufactures, on the importation of which the highest duties had been imposed, had fallen in price from twenty to fifty per cent.; that the consumption of cotton in American manufactories tended to enhance the market value to those who raised it, from one to two cents a pound; and that the protection of manufactures on a comprehensive scale, as proposed fourteen years ago, would not be injurious to commerce or diminish the value of any article of domestic produce exported. These things are not recalled to recollection for any other purpose than in their connection with the present occasion, as strongly indicating the difference between opinions founded on facts, and practical results, and those which rest on theory, abstract principles, or that political science, the professors of which may believe contains safer maxims and rules of conduct than those which have been consecrated by the test of time and experience in the connection of cause and effect.

To the members of this Institute, it must afford a subject of high gratification to be able to thus display to their fellow citizens this convincing conclusive verification of their past opinions, and the entire confirmation of all the declarations they had made of the benefits which would result to the whole community, by the adoption of a system of protection which they have so long cherished, in the perfect conviction that, when fully developed, and equally applied to the whole industry of the nation, its beneficent effects for the future, would justify their most sanguine anticipations, founded on the illustrations of the past.

Every article in this exhibition is as a living witness present to testify, to submit to any test or scrutiny however severe, and to be examined and cross-examined; with whatever preconceived opinions, they will not shrink from the comparison with the productions of other countries, as specimens of the progress of the mechanical arts, and an exemplification of the entire success of that system which sustained them in their infancy; and which in

their turn now sustain the system, by the most irrefragable evidence of its efficiency, wisdom, and justice. If we turn from the scene before us, to that which is afforded by a view of this great emporium of the commerce, this market and ware-house of a new world, the same appearance meets the eye, and the same pleasing subjects of contemplation are impressed upon the mind. Turn where we will, the progress of improvement is visible, every pursuit of industry has been in active and profitable operation, each contributing to swell the tide of prosperity which flows throughout. The shipping, which navigates your waters, and thickens around your wharves, and the customers who crowd to your market, attest the prosperity of your commerce, as plainly as your work-shops and this exhibition indicate the flourishing state of manufactures, while their combined influence is apparent and benignly felt in the whole range of their diversified operations.

The personal observation of all of us, in whatever part of the country it has been made, teaches, that no class of society profit more by the thrift of commerce and manufactures than the freeholder in the site of their pursuits and its vicinity, and the farmer who supplies their wants from the produce of his soil and labor. We have all witnessed the progress and decline of improvement, in towns, cities, and the surrounding country; but no one has seen either flourish, while its manufactures and commerce were declining decay, while their pursuits were profitable, or the success of one interest obstructing the growth of any other. In taking a still wider range, and embracing the results of the industry of the people, in all their occupations through the Union, under the operation of the system of policy which has prevailed for the last ten years, we find abundant evidence of general and progressive improvement in the condition of the country, the expansion of all its resources, the increase of domestic exports and tonnage, which are the unerring standards of general prosperity.

The increased value of the exports of domestic produce in 1833 over those of 1823 is, in the products of the sea $744,000, of the forest $488,000, of agriculture $17,697,000, of manufactures $3,600,000, of domestic tonnage employed in the foreign trade, entering and departing, 334,000 tons. (See Appendix, F.)

Such is the growing state of the country, under the operation of a general system of protecting duties during ten years, as exhibited in the public documents; surely, these facts must present to every citizen of this republic true cause of congratulation, in which none can more cordially join than the members of this Institute, who through good and bad report have never faltered in their efforts to bring about that state of things which all experience has taught to be the best calculated to secure permanent prosperity to all parts and interests of the nation. Increased products from the land, the forest, and the sea, steady and uninterrupted advance in all the mechanical arts and manufacturing operations, employed in the fabrication for domestic consumption of all the materials furnished from every source, yielding a surplus for exportation in exchange for what is profitable to import; with a commerce daily swelling in all the employments of transportation, in the foreign, coasting, and internal trade. This happy condition is one which must excite one universal feeling of exultation, which may be freely indulged on an occasion like the present. These annual exhibitions are not prepared to celebrate the triumph of a party, or to recall the remembrance of past excitement between one class of our citizens and another, on the interesting questions of national policy, which have heretofore agitated the country. They are in miniature what the official statements from the Treasury are on a great scale: the one displays the state of the nation in the useful arts, by representing in detail the varied productions of mechanical labor and skill; the other, the aggregate fruits of labor in all its employments, so far as they become materials of commerce for exportation. Both afford useful matter for reflection: they teach us that the legislative encouragement of manufactures is not attended with those pernicious consequences which many had predicted; that discriminating duties on foreign productions are as indispensable to infuse life and activity into the other branches of industry, as those on tonnage to sustain navigation; and that the same system of policy which sustained American commerce in its infancy, has been happily applied to its manufactures, and produced the same beneficial results on the country at large.

Look to what part we will, we see the extension of improvement. Those parts which have been the longest settled, far from exhibiting the symptoms of declining age, are still growing in all the vigor of youth, while they are planting their colonies in what a few years since was a wilderness, where no white man lived save the Indian trader, or the scattered remnants of the Canadian settlers; new States are now assuming their equal station in the confederacy, and rising to greatness with a rapidity unknown in the history of nations.

Equally progressive, though with unequal steps, the old States and the new are increasing in population, agriculture, commerce, and manufactures; yet, widely as they are separated, varied as are their productions, their occupations, habits, and local institutions, they are but the component parts of one great whole, united by one common interest, which brings to the commercial emporium the buyer and seller, the producer and the consumer, the merchant and his customers—all profiting by purchase or exchange, and each contributing to the thrift of the other.

If there is any one class of society to whom this state of things is more profitable than another, it is to that which is employed in the pursuits of commerce; all others are dependent upon them for the sale and exchange of their surplus productions, and their distribution and consumption in distant or foreign markets. Whatever increases this surplus for distribution through the various parts of our country, or exportation, is the creation of new materials for com-

merce, and enlarged profits in navigation; and whatever increases the profits of those who produce or fabricate articles for sale, exchange, or freight, makes them the more valuable customers for the merchant. Need it be asked, whether the exportation of near four millions of domestic manufactures is in aid of the operations of commerce, or whether the transportation of cotton from the place of production to the place of its domestic manufacture, from thence to the consumers, and the export of two millions and a half of cotton goods to foreign markets, contributes more to reward commercial enterprise than the importation of the same amount of foreign manufactures? Nor need an appeal be made to any one present, whether his property consists in lands, or lots in town or country, here or any where within the wide boundaries of our republic, in merchandise, in shipping, in stocks, or other securities—if he believes that the profits which any of the mechanics or manufacturers may have acquired in their various pursuits have been at his expense. If every branch of protected industry which has produced the various articles which compose this exhibition should be displaced by foreign competition, is there any one who hears me who would not feel its effects with regret; nay, if any one item in this splendid display should be thrust from the pale of protection, and no specimen of its domestic manufacture be found at some future anniversary of this Institute, is there any man whose feelings it would gratify, or whose interests it would advance?

We have all witnessed the expansion and contraction of the great interests of the country; and though we may not all agree in opinion as to the causes which have produced the varying results, we cannot disagree in the fact, that within the last two years there has been a marked and decided change in its general state, and that it has been from the worse to the better. That the national legislature has acted on its most interesting concerns in the regulation of its commercial intercourse, and the efficient protection of its industry, by increasing the duties on imports, and disencumbering the pursuits of our citizens from the burthens and obstructions placed upon them by foreign governments. The laws passed during this period were of no doubtful character; their provisions have borne directly on every interest, and cannot have failed to impress their effects on every thing they regulated. Our personal knowledge of the condition of the country, from the close of the late war till 1823, and its exhibition in the public documents, presents the recollection of a gloomy disheartening scene, which no friend to its welfare would not be unwilling to witness again. Since then there has been a "transition from gloom to glory," in one great department of industry, and from adversity to prosperity in all.

As the effects of legislation became unfolded in their operations, this transition became visible in the field, the town, the workshop, the manufactory, the river, the seaport, and on the ocean; life, activity, and success, were infused into all occupations; each succeeding year expanded the old, and developed new sources of wealth as incentives to labor and rewards to industry. And while foreign manufactures were gradually disappearing in our markets, domestic ones supplied their place to the advantage of the consumer. Whether this change was brought about by the protecting policy of these laws, or some invisible intangible principle, not before operative or perceptible, produced these effects without or in spite of legislation—whether the benefits which have gone hand in hand, or closely followed the action of the laws, are the direct emanations from their provisions, as the effects of the moving cause, or have been elicited by the collision of legislation with the doctrine of a political prince,—matters but little to those who are anxious only to discover and follow the road to private and public happiness.

The advocates of a protecting system may trace its effects in the altered condition of things since its developement; its opponents may believe that our progression has been owing to other more operative causes, existing in the practical application of the principles of political economy; but when the fact is conceded, that all the interests of the nation are in a healthy thriving condition, it is also an admission, that the system has at least been harmless in its operation. Whether a greater degree of success would have rewarded the labor of the people without it, is matter of opinion and argument. Those who are impressed with this conviction, however, would scarcely venture to hazard their own interests by an endeavor to so modify the existing system as to withdraw the protection it affords to that branch of industry in which they are employed, and leave it to regulate itself by the rules of the science against the commercial regulations and policy of foreign nations. They would surely not expect that those who hail the protecting system as the source of our greatest blessings, will act on the principles urged in argument, but discarded in practice. They at least must be permitted to await the result of a practical experiment upon an unprotected, unregulated commerce with foreign nations, and the navigation of the country carried on without discriminating duties on tonnage, and merchandise, or reciprocity, before they can consent to put their own interest in jeopardy. By disavowing their opinions, and the policy under which it flourishes, or in following abstract principles, which neither the lessons of experience or the instructive facts before us can sanction, the substance may be lost by the pursuit of the shadow. If we are not content with our present condition, and seek to improve it by the adoption of some other system, we ought to have some assurance at least of indemnity.

The public documents exhibit to us the balance sheets of the nation for the last ten years, in the combined results of its industry; and the condition of the country enables us to ascertain to which side of the profit and loss account the balance of our foreign commerce is to be carried. But, large as it is, this is now a matter of small concern in comparison to the coasting and internal trade, which has swelled to an amount beyond calculation; for who would compute

the extent of the fruits of that industry, which after supplying the demands of fifteen millions of people furnishes seven millions for exportation. It is in this great department that the rising greatness and glowing prospects of the country appear in dazzling brightness, while its foreign commerce, though buoyant on the full tide of successful pursuits, emits but the paler ray. Though in the sphere of its operations it takes a wider range, the amount of capital employed, of exchanges made, and profits earned, is less than in the purchase, exchange, and transportation of the raw materials and provisions of the south and west, and the manufactures of the eastern, middle, and western states.

Had this been predicted ten years ago, it would have been called the dream of an enthusiast; and so would an assertion that a Fair prepared with all the labors of the then Mercantile Society of this place, would within twenty years have been of the character of those which have now for the seventh time been opened under the auspices of the American Institute.

The most zealous friends of the American system have been astonished at its results. They had calculated on a steady uniform progress in all the business of the country, but were not prepared for this mighty expansion of all its resources. We had been led to expect, that our establishments could become matured only in the fulness of time, and that the fruition of our hopes might not be realized till the present generation had passed away. We had been so long in the habit of looking to Europe for the rules and course of trade, for the effects of the action of individuals and government on the industry of the country, that we had not been led to expect the accomplishment of our wishes at so early a period. The character of the American people seems to have been unknown to ourselves, or not to have been duly appreciated: slow to move in any new pursuit, ardent and persevering in the prosecution of all their undertakings, all experience had long taught us that they were rising in power as a nation, and happiness as men, yet the example of no people had ever shown that what was gained in power was not lost in time.

Judging from the scene which has been before our eyes, and the scene around us, as exhibiting the condition of the whole country, there seems to be an inventive creating spirit pervading all its works, which does not wait the slow and tedious march of time for its developement. Whether it is in the air we breathe, or exists in the nature of our institutions and system of policy, there is something like the presiding genius of invention and improvement hovering around the useful acts of the nation, which impels them onward with giant growth.

The exhibitions of this Institute afford evidence that cannot err; each item attests the fact, that whenever government removes the foreign obstructions on the industry of the nation, and the people are left free from foreign control in its pursuits, their skill and perseverance changes the face of the country, by establishments which are completed, and whose productions are exhibited for our admiration before we are aware of their existence.

As the practical effect of a protecting system, these exhibitions speak a language which strikes deeper into the mind than argument or reason; when a question is to be solved by a theory, principle, or opinion, as to what has been, what is, or what will be, the result of any measure of government on the interests of society, public sentiment will remain divided till facts remove doubts, and silence discussion. Thousands who would never yield their preconceived opinions to human authority, have surrendered them to the conviction of the senses, and the force of the testimony of the articles exhibited at this Fair, which are the silent witnesses of the truth which is in them, and the dumb orators who have made more converts to the American system than proud man in the plenitude of human intelligence has done, by all the efforts of reason, the profundity of learning, or the charms of eloquence. It is mainly owing to these that opposition has been disarmed, ancient feuds turned to lasting friendship; and the great interests of the country, once thought to be rivals, if not hostile to each other, have now become so harmoniously connected in their effects upon each other and the whole country, as to carry it forward to the height of greatness with the velocity of a steamboat, moving in all the majesty of mechanical power.

And who that witnesses this community of interest, which unites all society by the chain of mutual support, would if he could dissolve it, by striking from it the mechanical and manufacturing links which connect the agricultural with the commercial, and force those who are engaged in their pursuits to resort to foreign agency to continue the connection between them. Complete success has attended the system which now unites all the departments of national industry; we ought to cling to it, not merely for the good it has effected, but the venerated sources from which it sprung. The great principles on which the American system is erected were asserted in the first dawnings of the revolution; resistance to parliamentary taxation, and the encouragement of domestic manufactures, were the kindred emanations from the spirit of independence'; but one sentiment prevailed with individuals, in town meetings, in county and provincial conventions, and in Congress, from their first assembling in 1774, till the establishment of the constitution. The first confederation between the colonies was an association drawn up in Congress in October 1774, and signed by all the members, in which "for themselves and the inhabitants of the colonies whom they represented, they firmly agreed and associated under the sacred ties of virtue, honor, and love of country, that, 'we will in our several stations encourage economy, frugality, and industry, and promote agriculture, arts, and the manufactures of this country, especially that of wool.'"

When the several colonies became independent states, and adopted the articles of confederation recommended by Congress, each retained and expressly reserved a right, which is the

basis of the American system of protection to agriculture, the arts, the manufactures, and commerce of the country, nay, its vital principle. The States deemed this right to be too precious to be delegated, and its exercise too indispensable to their means of happiness, to be entrusted to any body of men except the immediate representatives of the people.

The ninth article of confederation, which gave Congress power to enter into treaties, and alliances, provided, "that no treaty of commerce shall be made whereby the legislative power of the respective States shall be restrained from *imposing such duties and imposts on foreigners as their own people are subjected to*, or from prohibiting the exportation or importation of any species of goods or commodities whatsoever."

Nothing could so clearly denote the state of public opinion, as in this denial of a power to impose duties and imposts in the same instrument which delegated the powers of war, peace, and of forming alliances, without restriction. No rule of policy in our commercial intercourse with foreigners could so strongly manifest the determination to resist and counteract all foreign laws, which imposes burthens upon the people of the States; and no means devised whereby their industry could be so effectually protected from injurious foreign competition, as that pointed out—"Imposing such imposts and duties on foreigners as our own people are subjected to by them."

If this could have been done by the Congress of the confederation, the fruits of the revolution would have been sooner realised, but as the States would not act in concert in regulating commerce or imposing duties on imports, and Congress could not act, except by recommendations, the call for a new government became universal, and in the constitution which created it, there was a grant of all the powers necessary to effectuate the objects of its institution.

The first work of the new government was the establishment of an American system, in the spirit and on the principle of the revolution. It announced to the people the great outlines of its policy in the preamble to the first revenue law, by declaring that duties were laid on goods, wares and merchandise imported, for the support of government, for the discharge of the debts of the United States, and the encouragement and protection of manufactures. The provisions of this law develope, in strong light, the leading features of the system, in the duties imposed on the imported products of the land, the sea, and manufactures, and the heavy discrimination of duties between articles imported in American and foreign vessels.

But the protecting principle was more strongly developed in the act for imposing duties on tonnage, as a measure of countervailing policy against the operation of the British navigation laws; and by an unvarying course of legislation since, it has been carried to the full extent of imposing on foreigners the same duties to which our own navigation is subjected, and is relaxed only in favor of those nations whose navigating interest is protected by no discriminating duties between theirs and American shipping entering their ports.

This was in accordance with the great purposes of the constitution. In giving to Congress the power *to regulate commerce*, it was not intended that it should be left to regulate itself, still less to permit foreign nations to regulate it for themselves and us without counter-action. Nor when the States had parted with their power to impose such duties on imports, as other nations imposed on their exports, could Congress fulfil their obligations to the people by declining to execute this power for their protection. They were bound to exert it to any extent which the interest of the country required; at least, so far as either to coerce other nations to adopt the rule of reciprocity in trade and commercial regulations, or, if the attempt should be fruitless, to meet duty by duty, regulation by regulation, law by law.

No government can be faithful to the people who support it, that would be content with less—for it is the only means whereby their infant establishments of manufactures and navigation could be rescued from foreign control, or the country enjoy the benefits of its own resources. The happy effects of the course of the government, in its early operations, soon became visible in the successful pursuit of all those occupations which were embraced within its guardianship; in whatever branch of industry, there was a domestic capacity to supply the domestic demand, the competition among our own citizens prevented undue exaction.

The monopoly of the coasting trade, and the preference in the foreign, which our navigation acts gave to American vessels, was a benefit to the whole country; and so far as any article of manufacture was secured from foreign control, by protecting duties on imports, the same consequences were apparent; and had this protection been gradually expanded, according to the growing capacity of the country to supply, it is most confidently believed that public opinion would long since have been unanimous in its favor.

It was only necessary to follow up the original policy of the government, and to apply it from time to time to any item of the productions of domestic labor, which could be encouraged without a permanent burthen to the consumer. As the progress of the country developed the actual results of its legislation, and especially after the late war had, by the extinguishment of foreign commerce, forced the country into the necessity of manufacturing their own materials, and practically demonstrated its abundant capacity of a competent production, the return of peace was thought to be the time for a revision of our revenue laws and an extension of protection to many articles not before encouraged, by any other than an ordinary duty for revenue. The tariff of 1816 operated upon its protected articles with the same results as had been before apparent—in economy to the consumer, by the improved quality and diminished price of the domestic production. When the experience of more than thirty years, without an exception, had

practically shown this fact, a more general system of protection was adopted, after a most protracted and excited discussion: the tariff of 1824 was avowedly for the encouragement and protection of domestic manufactures, and that of 1828 still more decidedly so.

We are all witnesses of their effects; the tree and its fruits are before us—are they good or evil? The whole country has tasted of them, and they are not only goodly to the eye, but have proved to be healthful to the body politic.

There is no evidence that the consumer or exporter of domestic manufactures has used, sold, or exchanged them at a loss; if their materials, texture, quality, or appearance, is inferior to the imported article, or higher in price in the domestic market, than in the place of their production abroad, it is difficult to account for the admitted fact, that they command a foreign market. The exporter must pay the price in the home market, and being entitled to the benefit of a drawback on the foreign article, duties give no preference to the domestic; the purchaser is therefore governed only by the quality and price. In the foreign market, the foreign and the domestic articles are on neutral ground, where there is no protection to either, other than in those inducements to the purchaser which tend to his own interest. This fact alone must dissipate the illusion, that protecting duties are of course an addition to the price of an article in the domestic market, or a tax on the many for the benefit of a few.

Another fact, now evident in the course of trade, is equally convincing to show the small effect of duties upon the price of imported goods, whether they are articles of comfort, necessity, or luxury, food, or raiment, the product of agriculture or manufactures. The price of tea, coffee, worsted stuff and silk goods, has not fallen to the extent of the duties reduced or repealed; and it is believed that some articles have raised in price, and that none have declined in proportion to the reduced duties. (See Appendix.)

From these facts we may draw instructive lessons; they teach us that domestic competition is the only security against foreign exaction, and that when we are dependent on the foreign market exclusively for our supply, the price of the article will be regulated, not by the cost or value of the production, but the wants of the consumer. It is in facts alone that political truths can be found; they are the book of nature and of life, enabling us to trace the effects of systems of policy on the course and operation of trade and human industry in all the occupations of society. They are the elements of the practical science of government and politics, which test the wisdom of its measures by their effects on the community: the touchstone to which to apply theories, doctrines, or received principles, by which to decide whether they are the illusions of the imagination, or the steady rules which govern human action in the various pursuits of man. When facts speak, it is the voice of nature, and must be obeyed; facts are stubborn, unyielding, obstinate; reasoning is lost upon them; principles may be drawn from them, which are safe guides to individuals and nations, but the conduct of both must be without wisdom, reason, or correct results, whenever it is attempted to force theories into them, instead of extracting truth and principles from them.

Do we want to understand the science of political economy, in order to learn what is the strongest, safest, most permanent foundation of national prosperity, we look first to the frame of our government, next to its laws, and then to their effects as displayed throughout the country. If in all its movements we find the machinery impelling it to greatness, with a controlling moral influence abroad, and general happiness at home, the statesman can accomplish and the patriot can desire no more, and no citizen should risk what he enjoys, by wishing to disturb the social order around him.

In its legislation on the industry of the people, our government has followed the steps of its founders. In completing their work, it has been guided by the spirit which descended to them from the Congress of 1774; it has promoted agriculture, the arts, and the manufactures of this country. It has adopted and developed the great principle of policy, consecrated in the confederation, of imposing on foreigners the same imposts and duties as our people are subjected to; and thus and otherwise, in regulating commerce with foreign nations, and laying and collecting imposts and duties for the support of government, the payment of the debts of the country, and the protection and encouragement of domestic manufactures, effected the great objects, by executing the powers conferred by the constitution.

If human authority can give sanction to a system—if there have been any men whose opinions ought to be regarded as maxims, and whose principles and rules of action are entitled to respect, through all time,—they are those who signed the association of 1774, the confederation of 1781, who framed the constitution, and devised the American system of policy in 1789.

Till wiser and safer counsellors shall appear, to instruct us with sounder maxims, to impress upon us more practical truths, and give assurance that more public good will follow a change of policy, or an abandonment of a system, thus adopted and matured, than by adhering to it—the trodden path is the safest; laid out in wisdom and illumined by experience, it has been the road in which our country has made an onward progress to its present condition. It has not been without its alternations of prosperity and decline; but ultimate success has rewarded national industry in all employments, and the system by which it has been regulated has not only dissipated all the fears entertained by its adoption, but more than realised all the benefits anticipated by its most zealous advocates. As lately modified, this system does not consist in the rate of duty alone; its essence is in an efficient discrimination between the foreign and domestic product, so assessed, enforced, and paid, as to be an actual toll in our market, to the extent

of the duty; and so apportioned, that whatever is paid into the treasury by imports shall be operative in the protection and encouragement of national industry.

A moderate duty, faithfully assessed and promptly paid, without evasion or fraud, is the most effectual protection; after manufacturing establishments have acquired a maturity, the possession of the market at home, and produced a surplus for exportation, the duty ceases to operate to protect them, they can protect themselves,—if such duties remain as counteract the bounties, premiums, drawbacks, and other advantages which the regulations of foreign governments give to the exporters of their manufactures. If none should exist, and any assurance could be given, that combinations of foreign capitalists would not for a time fill our markets at a price below the cost, in order to break down the competition of our own manufacturers, and thus secure its permanent supply for the future at whatever price they may exact, the repeal of the duty on any article which can find a foreign market with a profit, or which by its quality and price has excluded the foreign article from ours, would be harmless in its effects.

But when the domestic market is in the possession of the foreigner, and while manufactures are in their infant state, the foreign article can be superseded only by such duties as will place the domestic in a position of competition, on equal terms, which counterbalances the advantages of possession and of foreign regulations.

In applying these views to the late modifications of the system, there is great reason to indulge the confident hope, that they will produce no injurious consequences; on the contrary, much good may follow, if it is properly understood and duly appreciated. An exciting alarming subject of controversy has been put at rest, a distracting question of national policy has been settled in a spirit of compromise, by mutual concession; the one party receding in the rate of duty, the other advancing in beneficial regulations, to secure the prompt payment; and as in all compromises, both acting in good and mutual faith to carry its outlines into detail. As an established land-mark between neighbors by mutual consent, it will be respected by each as their own act; as an amicable measure, it will conciliate and unite opinions heretofore in collision, and will be more calculated to ensure its own perpetuity, than if it had been passed by mere numbers or a majority however decisive.

This measure must not now be viewed, as it would have been, while the manufactures of the country were prostrated, though it might not have sufficed to sustain existing or to encourage the establishment of new ones, ten years ago; yet it must be remembered, that after a long successful progress under the decisive protection of former laws, the present acts upon them in their healthy thriving condition. The capacity of the country to supply its consumption is now ascertained beyond all doubt, by the fact of the exportation of its manufactures in amounts annually increasing; the dead point has been passed, the domestic article is in possession of the domestic market, and the foreign artisan must now struggle as hard to recover it as ours have done to oust them. Possession is as important in trade as in law, perhaps of the two the easiest to maintain, and the most difficult to divest; and who that has looked upon these specimens of our domestic merchandize, which we have seen displayed at the Fair, and now command the domestic and foreign market, by the aid of past protection, can doubt their ability to maintain their possession with what is secured to them for the future. It is scarcely credible that the foreigner, who must pay on entry a double tythe, for the privilege of a market, can continue a profitable competition with our own citizens, who pay no toll; who are protected by public policy, public opinion, and by laws which inflict heavy penalties for evasions, and forfeitures for frauds. If the efficiency of the protecting system has been impaired by the reduction of the duties on imposts, it has been greatly strengthened by the reduction of credits; their extension was a crying evil in the former laws, which called loudly for the change, and having been repealed leaves the protection efficient. After an anxious consideration of the existing system in its general provisions, and great outlines, a confident belief is entertained, that in the then existing state of the nation, of public opinion, and the manufacturing interest of the country, it was a measure of wise and sound policy, conducive to the public peace, the harmony of the national councils, and not injurious to its prosperity in the aggregate or any of its great constituent powers.

In relation to that branch of national industry in which you, Mr. President, the Members of this Institute, and your associates in their respective stations in public and private life, have felt the liveliest interest, not because it more deserved, but more needed national protection, my settled conviction has been, and is, that the compromising bill is a salutary one; that it was happily timed; and that if it had not been passed, there was strong reason for the most alarming apprehension for the safety of the manufacturing interest at the ensuing session. The times were excited, an angry spirit was abroad, the protection of manufactures by discriminating duties had become not merely a party question, but one attended with most dangerous consequences to the peace and interest of the nation. It had become a local one; one section of the country seemed in array against the other, and every indication pointed to the disastrous effects of a protracted discussion. It was accepted in the spirit of peace and conciliation, which for a time seemed to have disappeared, but came at the appointed hour, with healing in its wings; the storm was allayed, harmony once more pervaded the halls of legislation, and local excitement ceased,—it is most devoutly to be hoped, forever.

So far as its consequences have been developed, they seem to have made no impression of an unfavorable kind on the operations of industry; whether other causes have operated injuriously,

can be no subject of inquiry on this occasion, nor can it be ascertained till the balance sheet of the current year shall be exhibited by the treasury, showing the kind and amount of exports. On the first promulgation of the measure, it was feared by many that the protective principle had been abandoned. But these fears are not justified by its provisions; the reduction of duties is gradual, spread over nine years, it can cause no sudden revulsion; it operates on established successful manufactures, which afford every prospect of attaining a foundation too solid to be affected by foreign competition before the reduction is completed. The permanent duty is not nominal; twenty per cent. is a high toll to pay, for the privilege of even competition in our market. Duties are no longer a loan and bounty to the foreign manufacturer; their prompt payment is an effectual tax upon him, not, as before, the means of accumulating his capital by a credit for which he paid no interest.

In contrasting therefore the present with former laws, there seems no good cause for alarm to that class of society who have the most direct and immediate interest in its operation, and there are many circumstances which gives to it a character most cheering. Public opinion is now more happily united than it has been at any former period; the protecting system as modified is now permitted to take its course; the temper of the times has changed; the storm which agitated the country has ceased; the policy of protecting domestic manufactures is no longer a subject of contention on the political battle ground; and rival candidates and their partisans have become contented to make their appeal for public support on other subjects. This question has been settled, not only by wise legislation, but the illustrations of experience and the testimony of facts; a victory has been achieved for the country and its most precious interests, yet it has not been the victory of a party which has left a sting or wound to rankle in the breast of the vanquished.

The tendency and effects of the present state of the country were pointed out by a distinguished patriot* more than seventy years ago, if not in the spirit of prophecy, at least in the full assurance, that the happiest condition of a people is that in which their different occupations are connected together, and united in one common pursuit, with no other rival feeling between those engaged in the various employments of life, than which shall effect the most for the good of all:

"The tradesman and the husbandman would do well to consider, that when they are for cramping trade, they are for killing a faithful servant who is toiling day and night, and eating the bread of care for their sake as well as his own. The merchant and the gentleman would do well to reflect, that the hand of the tradesman and husbandman are their employers, and that unless they increase and multiply in their commodities and riches, the merchant will never flourish. The merchant, the tradesman, and freeholder, should consider themselves as the most immediate and natural brothers in the community; that God and nature have made their interests inseparable; and when they will agree conjointly, no mortal hand can ever prevail against them."

APPENDIX.

A.

Extracts from Questions addressed to the Mercantile Society of the city of New-York, in 1821, by the Committee on Manufactures, from the Congress of the United States, with the Answers of the Society—showing the effect of protecting duties on the prices and quality of goods, and also on commerce and the production of the raw material in this country.

QUESTION 8th.—State the prices of the following articles in 1811, or any other year or years before the war, which will present a fair average of their price in the years of a flourishing commerce: Coarse Cottons, Umbrellas, Nails, Gunpowder, Playing Cards, Carriages, Cabinet Wares, Wafers, Hats, Boots and Shoes, and any other manufactured articles which were formerly imported, but are now in a great measure, if not wholly, made in the United States,—the relative quality of the imported and domestic articles?

ANSWER.—Common coarse Cottons, such as are manufactured in the United States, may be fairly stated to be 50 per cent. lower than in 1811, and are much superior to the piece goods of similar description from Calcutta.

Cabinet Wares are greatly superior, and full 25 per cent. lower.

Gunpowder,	-	do.	do.	-	-	25	to 50	do.
Umbrellas,	-	do.	do.	-	-	33⅓	"	do.
Carriages,	-	do.	do.	-	-	50	"	do.
Hats,	-	-	do.	do.	-	-	25	" do.
Boots and Shoes,			do.	do.	-	-	20	" do.

Silver Ware is now made in this country as cheap as in London, and is 12½ per cent. lower than in 1811.

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* James Otis.

QUESTION 9th.—Where the domestic has superseded the foreign supply of our market, state the general effect it has produced, as to price and quality; and whether it has resulted in the benefit or injury of the consumer?

ANSWER 9th.—As far as our own information has given us an opportunity of judging, the consumer is supplied with a better article for the same price; it is particularly so with Coarse Cottons, Hats, Boots and Shoes, Cabinet Wares, Carriages, Fancy Chairs, Looking Glass and Picture Frames, Silver Plate, Andirons, brass head Shovel and Tongs, Grates for burning coal, Gold Leaf, Woollen Satinets, Cut Nails, Fancy Mock Tortoise Shell, and fine Ivory Combs, Rifle Guns, Cut Tacks and Brads, and Tin Wares.

QUESTION 10th.—Taking the article of Cotton as an example, and supposing coarse Cotton goods are excluded, have the effects been injurious to commerce? Is there as much tonnage; are there as many seamen employed in the transportation of the raw material and the manufactured article coastwise, as there would be in the importation of the foreign manufacture and the exportation of as much cotton as would make the goods we import from Europe? If more or less, state the difference.

ANSWER 10th.—The exportation of the raw material to Europe, and the importation of the article when manufactured, would give employment to a greater number of seamen, and more tons of shipping, than the transportation of the same raw materials and manufactured articles coastwise. So far as relates to a prohibition of India Cottons (manufactured), our commerce has no doubt been benefitted, because it could only be employed in bringing an article manufactured from a raw material of foreign growth; whereas the raw material of which the substitute is made, as well as the manufactured article, are both transported coastwise, and give employment to more shipping and a greater number of seamen than the importation of India manufactured Cottons could possibly do. It would take five cargoes of unmanufactured Cotton to make one of manufactured goods.

QUESTION 12th.—Does the consumption of Cotton in the American manufactories diminish the price of what is exported to Europe; in other words, are, or can, the fruits of Cotton manufactories be injurious to those who raise the article?

ANSWER 12th.—The consumption of cotton at home increases the price to the growers; the demand in this market for home consumption is generally considered to keep the price from one to two cents per pound higher than it would otherwise be.

QUESTION 15th.—State your opinion of the probable operation of this bill on commerce; if injurious, point out specifically the objections. Would it decrease our tonnage, or number of seamen? Would it diminish the price of any of our articles of export—if so, state what? Is the price of these articles, and their demand abroad, regulated by the wants of other nations, or by the amount of manufactures we receive in exchange? State not only your opinion, but experience, and the information of others, that is to be relied upon, if no general revision of the tariff should be proposed.

ANSWER 15th.—We think generally it will not be prejudicial to commerce; it would not diminish the value of any article of domestic produce exported; the price of our articles abroad, and the demand for them, is regulated by the wants of other nations, and not by what we in return receive from them.

B.

A TABLE showing that a reduction of Duties on *Coal*, *Salt*, *Coffee*, and *Molasses*, has not effected a reduction of prices on those articles.

December 1.	*Coal per chaldron.*		*Salt per bushel.*		*Coffee per pound.*		*Molasses per gallon.*	
	Price.	Duty.	Price.	Duty.	Price.	Duty.	Price.	Duty.
1815	$23 00	$3 60	90 cts.	20 cts.	25 cts.	10 cts.	70 cts.	10 cts.
1816	14 00	1 80	60	20	21	5	50	5
1817	11 00	1 80	60	20	24	5	60	5
1818	11 00	1 80	70	20	30	5	53	5
1819	14 00	1 80	70	20	24	5	40	5
1820	.	1 80	62	20	29	5	30	5
1821	14 00	1 80	60	20	28	5	33	5
1822	.	1 80	60	20	25	5	33	5
1823	12 75	1 80	52	20	20	5	26	5
1824	15 00	2 16	50	20	17	5	28	5
1825	14 00	2 16	58	20	16	5	33	5
1826	10 00	2 16	49	20	15	5	30	5
1827	13 00	2 16	62	20	14¼	5	33	5
1828	13 00	2 16	52	20	13	5	24	10
1829	11 00	2 16	45	20	12¼	5	25	10
1830	8 00	2 16	55	20	12	5	30	10
1831	13 00	2 16	62	15	12½	2	30	5

C.

COMPARATIVE STATEMENT OF PRICES of sundry articles which are now admitted into the United States free of duty: showing the prices before and since the repeal of the duties thereon.

	October 1, 1830.		October 1, 1834.	
	Price.	*Duty*	*Price.*	*Duty.*
Tea, (hys.) per lb.	$1,12½	$0,87½	$0,42	Free.
Coffee, - -	11	5	10½	"
Currants, - -	9	3	4	"
Prunes, - -	14	4	5	"
Figs, - - -	6½	3	3	"
Nutmegs, - -	1,35	60	1,25	"
Cassia, - -	18	6	11½	"
Cloves, - -	45	25	19	"
Pepper, - -	14	8	7	"
Ginger, - -	8	2	5½	"
Camphor, - -	45	12	45	"
Indigo, - -	1,62	30	1,60	"
Raisins, bloom, box,	2,25	4	1,25	"

D.

A TABLE showing the prices of *Cotton* and *Coarse Cotton Goods* in the city of New-York for a series of years:

Years.	*Upland Cotton.*	*Brc. Cot. Shirtings.*
April, 1815,	20 cents per lb.	25 cents per yd.
" 1816,	28 " "	21 " "
" 1817,	28½ " "	21 " "
" 1818,	32 " "	21 " "
" 1819,	26 " "	19 " "
" 1820,	16 " "	12½ " "
" 1821,	13½ " "	12½ " "
" 1822,	15½ " "	13 " "
" 1823,	10½ " "	11 " "
" 1824,	14 " "	10 " "
" 1825,	19 " "	10 " "
" 1826,	11 " "	9 " "
" 1827,	9½ " "	9½ " "
" 1828,	10 " "	9 " "
" 1829,	10 " "	7½ " "
" 1830,	9½ " "	7 " "
" 1831,	9 " "	7½ " "
" 1832,	9 " "	7 " "
" 1833,	10½ " "	7 " "
" 1834,	11 " "	6½ " "

N. B.—One pound of cotton makes four yards of the above goods.

E.

A TABLE shewing the total value of sundry articles of American manufacture exported to foreign countries in the year ending September 30, 1833, with the protective duty on each article:

Manufacture.	*Amount Exported.*	*Protective Duty in 1832.*
Cotton Goods, - -	$2,532,517—average	80 per ct.
Flax and Hemp, - -	24,949 -	25 "
Wearing Apparel, - -	43,943 -	50 "
Combs and Buttons, -	142,970—average	25 "
Umbrellas and Parasols, -	21,380 -	25 "
Glass, - - - -	93,494—average	30 "
Printing Presses and Type,	16,599 "	25 "
Books and Maps, - -	48,946 "	30 "
Paper and other Stationary,	46,484 "	60 "
Leather & Boots & Shoes,	251,777 -	30 "
Household Furniture, -	200,635 -	25 "
Coaches & other Carriages,	28,830 -	30 "
Hats, - - - - -	243,271 -	30 "
Saddlery, - - - -	33,051 -	30 "
Snuff and Tobacco, - -	288,973 -	50 "
Iron—Castings, - - -	48,009—average	50 "
" —Pig, Bar, and Nails, -	72,177 "	75 "
" —Manufactures of, -	113,686 -	25 "
Spirits from grain, &c. -	144,069 -	150 per ct.
Earthen and Stone Ware, -	12,159 -	20 "
Cordage, - - - - -	23,140 -	40 "
Sugar, refined, - - - -	40,327 -	100 "
Gunpowder, - - - -	139,164 -	30 "
Copper and Brass, - -	203,880 -	25 "
Soap and Tallow Candles, -	673,076 -	60 "

The total amount of American Manufactures exported in the above year was - - - - - - $6,923,922

F.

The amount of domestic manufactures exported in 1823, not including uncertain articles, was.....			2,357,000
Amount in 1833, excluding coin and articles not enumerated, was.....			5,956,000
Difference in favor of the latter year.....			3,599,000
In 1823, the exports of manufactures of iron were only.....97,000—In 1833 they were			233,000
Hats.....	115,000—	" "	243,000
Snuff, tobacco,			
Linseed oil, &c...	175,000—	" "	313,000
Gunpowder.....	66,000—	" "	139,000
Brass & copper...	16,000—	" "	203,000
Medicinal drugs..	74,000—	" "	196,000
	543,000		1,317,000

The following articles are not in the list of exports in 1823. In 1833, there was exported:

Manufactures of cotton.....	2,532,000	
Combs and buttons.....	142,000	
Wearing apparel.....	43,000	
Books, maps, paper and stationary,	94,000	
Manufactures of glass.....	93,000	
Other articles, amounting to.....	215,000	
		3,219,000
In 1823, the imports of hats, caps, and bonnets, deducting exportations, were.....		$802,000
Hats of domestic manufacture exported.....		115,000
Balance of imports over exports.....		687,000
In 1833, the imports of leghorn hats, &c., were, deducting the exportation.....		116,000
Domestic hats exported.....		243,000
Balance of exports over imports.....		127,000
In 1833, the imports of manufactures of copper and brass were.....		351,000
Domestic articles exported.....		16,000
Balance of imports.....		335,000
In 1833, the imports were.....		403,000
Domestic articles exported.....		203,000
Balance of imports.....		200,000

G.

In 1823, the amount of cotton goods imported was.....		$8,867,000
Of which were exported.....		2,641,000
Consumed in the United States.....		6,226,000
No domestic cotton goods were exported this year.		
In 1833, the amount of importations was....		7,658,000
Of which were exported.....		2,404,000
Consumed in the United States.....		5,254,000
Domestic cottons exported.....		2,532,000
Balance of the exports and imports of this year		2,722,000
Less than 1823 by 6,226,000—2,722,000=3,504,000.		
In 1823, the imports of white cottons amounted to.....		2,636,000
Of which were exported.....		520,000
Consumed in the United States.....		2,116,000

In 1833, the amount of importations was....	1,181,000
Of which were exported.....	710,000
Consumed in the United States.....	471,000
Domestic white cottons exported	1,802,000
Balance of exports and imports in favor of the United States	1,331,000
Difference between the two years on this article	$3,447,000

In 1833, the imports of cotton goods from the British East Indies was, printed and colored 331,000, white 229,000..... $560,000
In 1833, printed and colored 43,000, white 2,580, 45,580

Difference between the two years..... $514,420

In 1833, there was exported to the British East Indies, of white domestic cottons 36,000, being 33,420 over the imports.

In the same year, there was exported of the same article to other English Colonies, 28,000. To the Dutch East Indies, 26,000.

Cotton goods exported to China in this year amounted to..... $216,000

The importations of cotton goods from China was 8,000, nankeens 30,000..... 38,000

Balance of exports and imports of this year on cotton in favor of the United States..... $178,000

In 1823, nankeens imported from China amounted to..... 595,000

In 1833, the amount of domestic manufactures exported to the dominions of Great Britain was.. $444,000

—

H.

The amount of cotton goods manufactured annually at Lowell is 37,504,000 yards. Value, $4,500,000.

Cotton consumed, 33,058 bales, or 11,600,000 pounds.

The amount of printed cottons exported from Providence, of the manufactories within 30 miles, is	$4,000,000
Add the cotton manufactures of Lowell, -	4,500,000
	8,500,000
The whole amount of imported cottons consumed in the United States in 1833,.....	5,254,000
Excess of the domestic article manufactured at and near these two places,.....	3,246,000

Estimating the consumpion of cotton at Lowell to be one-sixth of the whole domestic consumption, the number of yards manufactured in the U. S. is 225,024,000. Value, $27,000,000.

The relative amount of the domestic and foreign manufactures consumed in the United States will be found vastly disproportionate by referring to the population. By the census of 1830 it amounted to 12,856,000: of which 2,009,000 were slaves.

In 1833 the imports of woollen cloths and cassimeres, deducting exportations, was $5,5,800,000; cottons, $5,254,000; aggregate, $11,054,000.

This is about 87 cents for each individual; and for each slave, $5,57, which is a low estimate for the woollen and cotton clothing consumed by slaves annually.

It may, therefore, be safely estimated that the domestic manufactures of wool and cotton are equal in amount to the consumption of those articles by the whole free population of the United States, which is now from 12,000,000 to 12,500,000, allowing an increase of from 1,000,000 to 1,500,000.

Assuming at $11,054,000, the consumption of imported woollen and cotton cloth is $1 to each. The amount of the consumption of these articles by each individual beyond this sum, multiplied by 11,000,000, shows the excess of the domestic manufacture.

Assuming the consumption of each freeman to be double that of a slave, say $11,14, the whole domestic consumption would amount to $122,648,000.

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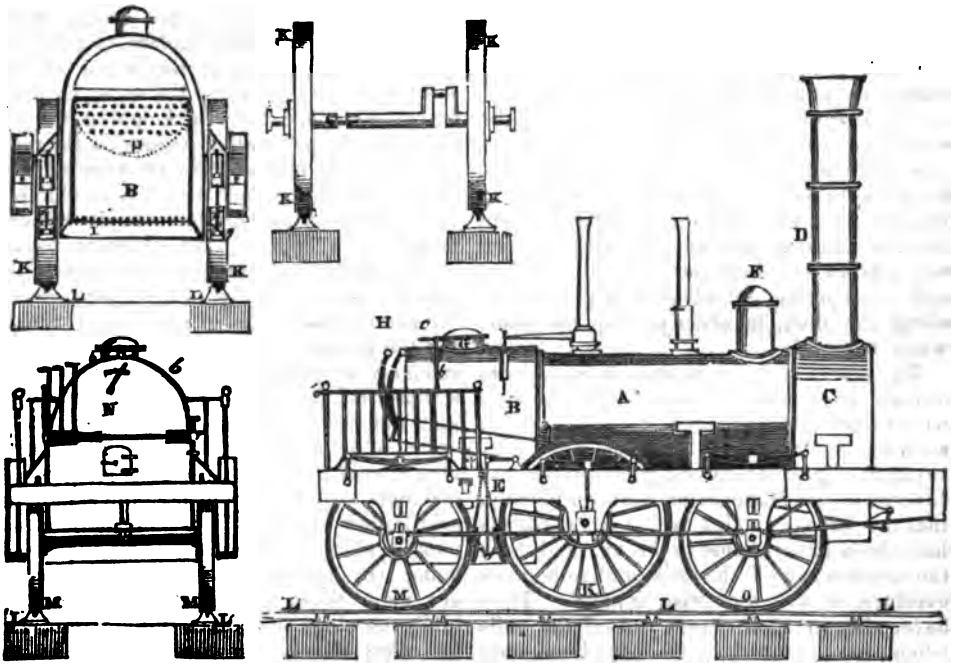
"Theoretical and practical men will most effectually promote their mutual interests, not by affecting to despise each other, but by blending their efforts; and an essential service will be done to mechanical science, by endeavoring to make all the scattered rays of light they have separately thrown upon this region of human knowledge converge to one point."—DR. OLINTHUS GREGORY.

STEPHENSON'S IMPROVED LOCOMOTIVE STEAM ENGINE.

Sheet I.



References.—A, the boiler; B, fire-box; C, smoke-box; D, smoke-pipe; E, suspension pin; F, steam head; G, man hole; H, working gear; J, fire grate; K, main impelling wheels; L, M, extra small wheels; N, throttle valve; P, tubes.

[From the Repertory of Patent Inventions.]

Specification of the Patent granted to* ROBERT STEPHENSON, *of Newcastle-upon-Tyne, in the County of Northumberland, Engineer, for a certain Improvement in the Locomotive Steam Engines now in Use for the Quick Conveyance of Passengers and Goods upon Edge Railways.—Sealed October 7, 1833.

My improvement in the locomotive steam engines now in use, for the quick conveyance of passengers and goods upon edge railways, is applicable to that kind of locomotive engines which are used in the Liverpool and Manchester railway (the first of which engines was called by the name of the Planet), having the two main wheels, which are impelled by the engine, fixed on a double cranked axis, and turned round by the force of the pistons of the steam cylinders, in order to advance the locomotive engine along the edge rails, whereon the said main wheels bear. And my said improvement consists in making the said main wheels of the locomotive engine (which are fixed as aforesaid) on the ends of the cranked axis,

and impelled by the force of the pistons, with plain tires to run upon the edge rails, without any projecting flanges on those tires, and applying two additional small wheels with flanges on their tires, beneath the hinder end or part of the engine, in order to cause that end of the engine, by means of those flanges, to keep straight upon the rails, as it runs along thereon, and also to bear up part of the weight of the furnace end of the boiler, in the same manner as the present two small wheels (by means of their flanges) keep that end of the engine straight on the rails, and bear part of the weight at the chimney end of the boiler, where the steam cylinders are situated. And also consists in applying the force of small extra steam pistons, or plungers, fitted into suitable cylinders, which, by turning a cock, can be supplied when required with steam from the boiler, in order to act upon a double brake, or pair of clogs, which are applied to the circumferences of the tires of the said main wheels without flanges, and of the two said additional small wheels with flanges, so as to press the said brakes or clogs in contact with the said circumferences, and thereby cause friction and resistance, which will tend to retard the motion of the wheels, and consequently the advance of the engine, along the rails, in order to stop the same when required.

The object of my said improvement is to obviate or diminish some inconveniences which have been experienced in the use of such locomotive engines, for the quick conveyance of passengers and goods on the said Liverpool and Manchester railway, namely, that the cranked axles of the great wheels have been found liable to break, and then the engines run off the rails, and sometimes overturn, or are otherwise injured. They have, also, in some cases run off the rails when the cranked axle has been only strained, without being actually broken; also, it is found difficult to hold on with the clogs or brakes to the wheels of such locomotive engines, according to the manner whereby the brakes are usually applied by hand, with sufficient force and steadiness to retard the engines from advancing along the rails, as much as is desirable, in order to arrest their motion as suddenly as possible when they have been travelling rapidly, and particularly in the event of arriving at a broken or deranged part of the railroad, or on any other occurrence which may occasion danger of collision with obstacles or other carriages, if the motion were not stopped with promptitude; and also the boilers of those engines have burned out very rapidly, in their internal tubes, so as to have occasioned great expense and loss of work in repairing them.

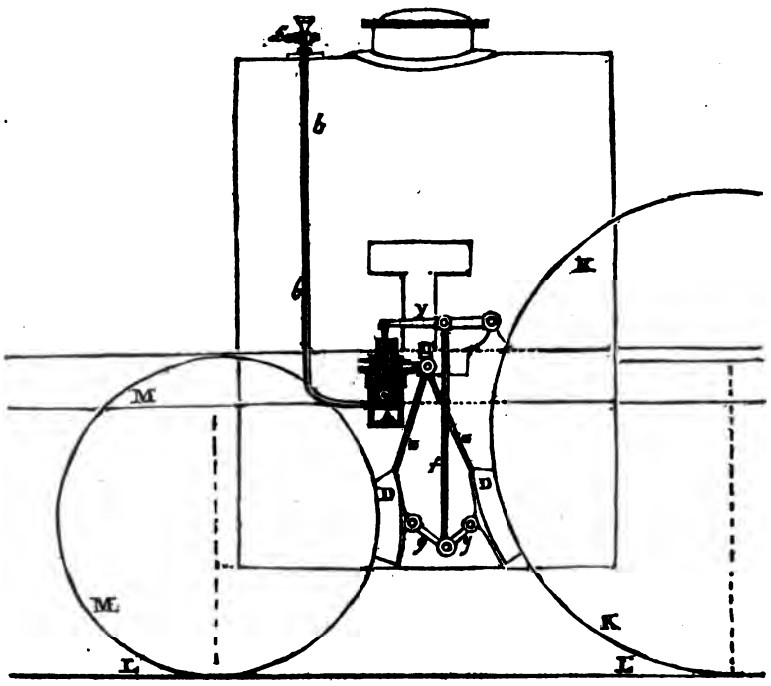
My said improvement in such kind of locomotive engines will tend to obviate or diminish the said inconveniences, for by using plain tires, without flanges, for the main impelled wheels (and which has never been done before in such engines on edge railways), the cranked axles of those wheels will not be subjected to any strain endways, in the direction of its length, when the engine enters into sidings, turnings, and crossings of the rails, or passes along curvatures in the line. * * * * * *

* * And by applying the pressure of steam from the boiler to act within hollow cylinders, upon pistons or plungers fitted into those cylinders, so as by the motion given to those pistons by the steam, when admitted into the said cylinders, to force the brakes or clogs against the edges of the wheels, in order to retard the same, by causing friction, and thereby stopping the advance of the locomotive engine on the rails. The stopping may thereby be effected with more promptitude, and with less trouble and effort than by the ordinary mode hitherto practised, of applying the clogs or brakes by the strength of the man who attends the engine; for, according to my improvement, the man, when warned of any danger, requiring the locomotive engine to be stopped as suddenly as possible, after having as usual stopped off the supply of steam to the engine cylinders, will have nothing to do in order to apply the brakes or clogs but to turn a cock in a small steam pipe, which conducts the steam from the boiler into the said hollow cylinders, wherein the said pistons or plungers are fitted, and the steam being (by opening the cock) admitted to act upon those pistons or plungers, will bring the clogs or brakes into action, with far more effect than can be done by the common mode of pressing them against the wheels by handle levers, actuated by man's strength; and also according to my improvement, the man, after having opened the said cock, and so brought the brakes or clogs into action by the force of steam, will have his hands at liberty to do any other duty that may be required of him whilst the engine is stopping. And note—the same effect may be produced by admitting water from the boiler, by a pipe and cock as aforesaid, into the said hollow cylinders, in lieu of steam, because the pressure of the water will produce the same effect on the pistons or plungers, and clogs or brakes, as that of the steam. And in order to release the said clogs or brakes, and take them out of ac-

tion, the aforesaid cock must be shut, to cut off the communication from the boiler to the hollow cylinders, wherein the pistons are to act, and another cock being opened to permit the steam (or water) which has operated in the hollow cylinders, to escape therefrom into the open air, and allow the pistons or plungers in those cylinders to return and release the brakes or clogs. The additional small wheels which I apply beneath the hinder end of the boiler, will sustain the extra weight of a larger boiler than heretofore used, without distressing the rails; and bearing springs are to be used for the extra small wheels, the same as is now done for other wheels in the ordinary engines, and the said springs will cause all the six wheels to apply and bear fairly on the rails, and ease all jolts and concussions. The relative weights or portions of the whole weight of the engine, which shall be borne by each of the six wheels, being regulated by the strength and setting of their respective bearing springs. The main wheels, which are to be impelled by the power of the engine, being in all cases left loaded with as much of the weight of the engine as will cause a sufficient adhesion of those wheels to the rails to avoid slipping thereon. When by virtue of my improvement a larger boiler is used, containing more heating surface than heretofore, a less intense excitement of the combustion will be required in order to produce the necessary quantity of steam for the supply of the engine, and that diminution of the intensity of the combustion will be advantageous to the performance of the engine for another reason, as well as by avoiding the heretofore rapid burning out of the metal of the boiler, because the jet of waste steam (which is thrown into the chimney to produce a rapid draft therein, and a consequently intense combustion of the fuel,) may be greatly diminished in its velocity, and thereby the waste steam will be allowed to escape more freely from the cylinders than heretofore, when a very sharp and sudden jet of the waste steam up the chimney is found absolutely necessary to excite that intense violence of combustion which can alone enable the present boilers to yield the requisite supply of steam, but that very sudden jet can only be obtained by throttling the eduction passage, and thereby impeding the free discharge of the steam from the working cylinders, so as to impair the force of the pistons; and at the same time, the excessive combustion which is excited (by so impairing the force of the pistons) also destroys the metal of the boiler in a short time. Increasing the magnitude of the boiler, giving a larger extent of heating surface thereto, and working the enlarged boiler with a more moderate intensity of fire, is the true remedy, and will save fuel as well as avoid the rapid destruction of the boiler, because the steam will be allowed to escape more freely from the cylinders. The adoption of larger boilers in the said locomotive engines, with all the advantages to be derived therefrom, as aforesaid, depends upon the application of the two additional small wheels beneath the furnace end of the boiler, because the present engines are already too heavy on the rails, and require a diminution of weight instead of an augmentation. But I wish to be understood, that I do not claim the use of six wheels instead of four, as an improvement merely for better supporting the weight distinct from other circumstances hereinbefore set forth, but I claim the using of large wheels without flanges on their tires, which wheels are to be fixed on the cranked axle to serve for the impelled wheels of locomotive engines, which are to travel on edge railways, and in conjunction therewith, (but not without that conjunction,) the application of a pair of extra small wheels, with flanges on their tires, beneath the hinder end of the boiler, with interposed bearing springs, like those of the other wheels; that application of extra small wheels with flanges, conjointly with the said using of large impelled wheels without flanges, being for the purpose of keeping the engine straight on the rails when it runs forward, as well as for bearing up part of the weight. And also I claim, as part of my said improvement, the application (as hereinbefore described) of the pressure of the steam or water from the boiler, to act when required in hollow cylinders on pistons or plungers, which are connected with the clogs or brakes for the wheels, so as to bring the said brakes or clogs into action by the pressure of the steam instead of by the strength of men, as heretofore done. Note—I make no claim to the use of six wheels in locomotive engines to travel on edge railways, if the impelled wheels have flanges, but only when the said impelled wheels have no flanges; and for the more complete explanation of my said invention, I have hereunto annexed three sheets of drawings, (No. 3 is omitted in the engravings,) representing two locomotive engines for the quick conveyance of passengers and goods upon edge railways, when constructed according to my said improvement.

Sheet I. contains a side elevation, end elevation, and end section of such an engine. x are the main impelled wheels on the

Sheet II.



i, moveable plunger

cranked axle, without any projecting flanges on the tires, which run on the edge rails. L, M, are the extra small wheels with flanges, applied beneath the hinder or furnace end of the boiler; and O are the ordinary small wheels with flanges beneath the chimney end of the boiler, where the working steam cylinders are situated. The small wheels, O and M, with flanges, keep the engine straight on the rails as it runs forwards thereon; and the large impelled wheels, K, have only to advance the engine forwards, and to bear a due portion of its weight, without having any thing to do with keeping the engine on the rails, having no flanges which can hold laterally on the rails; wherefore the cranked axle of the wheels, K, is liberated from all stress by any lateral action of the great wheels K against the edges of the rails; and the small wheels, O M, with flanges, (which wheels have straight axles,) sustain all the stress of that lateral action.

Sheet II. contains a separate drawing of the brake or clog, which is also shown in its place in sheet I. A is the hollow cylinder into which a plunger is fitted, to act by a lever, *y*, and an upright rod, *f*, upon the two clogs or brakes, D, D, which are suspended by pendulous links, *z*, from a centre pin or bolt, E, fixed to the frame. The clogs or brakes, D D, are caused to apply to the circumferences of the tires of the wheels, K, and M, by means of links, *g*, *g*, which are interposed between the two clogs or brakes, D, D, and which links, when put down into an angle, as shown in the figure, leave the brakes or clogs, D, D, free of the wheels, K, and M; but when by opening the cock, *c*, the stream from the boiler is admitted through the pipe, *b*, *b*, into the hollow cylinder, A, it raises up the plunger therein, and that by its lever, *y*, and rod, *f*, draws up the links, *g*, *g*, towards a straight line, and then they force the two clogs or brakes, D, D, apart from each other against the wheels, K, and M, with an increased force beyond that which the plunger exerts; that increase of force being in consequence of the leverage at *y*, and the oblique direction of the links, *g*, *g*. When the handle of the cock, *c*, is turned the other way, it allows the steam to issue through an upright spout, and escape from the cylinders into the open air.

Enrolled December 3, 1833.

METHOD OF BUILDING CHIMNEYS THAT WILL NOT SMOKE.—Contract the space immediately over the fire, so you may be sure of the air being well heated *there*; this will ensure a current upwards. All chimneys should be carefully built, and every joint well filled with mortar, so as to prevent communication in case of fire.—[Dr. Thomas Cooper.]

A Compendium of Civil Architecture, arranged in Questions and Answers, with Notes, embracing History, the Classics, and the Early Arts, &c. By ROBERT BRINDLEY, Architect, Surveyor, and Engineer. [Continued from page 278.]

SURVEYOR'S MEMORANDA.

I.—*Digger.*

27 Cube feet, one cube yard or single load.
54 Cube feet, two cube yards or double load.

II.—*Well Digger.*

ft.	in.		
3	0	Diameter in the clear, between brick-work, will contain, in each foot in depth, - -	43 galls. water.
3	6	in clear - -	59 do.
4	0	do. - - -	77 do.
4	6	do. - - -	98 do.
5	0	do. - - -	120 do.
5	6	do. - -	146 do.
6	0	do. - - -	173 do.
6	6	do. - -	203 do.
7	0	do. - - -	235 do.
7	6	do. - -	270 do.
8	0	do. - - -	308 do.
8	6	do. - -	348 do.
9	0	do. - - -	390 do.
9	6	do. - - -	435 do.
10	0	do. - - -	480 do.

III.—*Bricklayer.*

272 Feet superficial, 1 rod of brick-work, at 1½ brick or 13½ inches thick, which is considered the standard thickness, and to which all brick-work is reduced.

306 Cube feet, one rod of reduced brick-work, being the cube quantity produced by multiplying 272 feet by 13½ inches (or 1½ brick, the standard thickness of all brick-work.)

4500 Bricks (allowing for waste) will build one rod of reduced brick-work.

17 Bricks to each reduced foot of brick-work.

8 Bricks to one foot superficial of marle facing, laid Flemish bond.

10 Bricks to one foot superficial of gauged arches.

To reduce Cube feet of brick-work to the standard thickness of 1½ brick, multiply by 8, and divide by 9; the standard thickness of 1½ brick or 13½ inches being nine eighths of a foot.

A stock brick is 8¾ inch. long, 4¼ inch. wide, and 2¼ inch. thick; each brick weighs about 4 lbs. 15 oz.

IV.—*Brick and Tile Paving.*

9 Feet superficial, one yard of paving.

72 Paving bricks laid on edge will pave one yard.

52 Stock bricks on edge to one yard.

144 Dutch clinkers laid on edge to one yard.

14 Ten inch tiles will pave one yard.

10 Foot tiles will pave one yard.

A paving brick is 9 inch. long, 4½ inch. wide, and 1¾ inch thick; each brick weighs about 3 lbs. 13 oz.

A Dutch clinker is 6¼ inch. long, 3 inch. wide, and 1½ inch thick; each clinker weighs 1½ lb.

A foot paving tile is 11½ inches square, and 1½ inch thick; each paving tile weighs about 12 lbs. 4 oz.

A ten inch paving tile is 9½ inches square, and 1 inch thick; each paving tile weighs about 8 lbs. 9 oz.

V.—*Tiling.*

100 Feet superficial to one square of tiling, &c.

768 Plain tiles to one square of tiling laid to a 6 inch gauge.

655 Plain tiles to one square of tiling laid to a 7 inch gauge.

576 Plain tiles to one square of tiling laid to an 8 inch gauge.

180 Pan tiles to one square of tiling laid to a 10 inch gauge, with 1½ inch side laps.

A plain tile is 10½ inches long, 6½ inches wide, and ½ an inch thick; each tile weighs about 2 lbs. 5 oz.

A pan tile is 13½ inches long, 9½ inches wide, and ½ an inch thick; each tile weighs about 4 lbs. 11 oz.

A square of plain tiling, say 700 tiles to a square, will weigh 14½ cwt.

A square of pan tiling, 180 to a square, will weigh 7½ cwt.

VI.—*Laths.*

100 Plain tile laths, 5 feet long, or 500 feet running, of any length, one bundle.

125 Ditto, 4 feet long, one bundle.

167 Ditto, 3 feet long, one bundle.

1 Bundle of laths to one square of plain tiling.

12 Pan tile laths, 10 feet long, one bundle.

1 Bundle of pan tile laths to one square of pan tiling.

30 Bundles of plain tile laths, one load.

Plain tile laths are 1¼ inch wide, and a quarter of an inch thick.

Pan tile laths 1½ inch wide, and 1 inch thick.

VII.—*Lime.*

25 Striked bushels, or 100 pecks, one hundred of lime.

8 Gallons, or 2218¼ cubical inches, one bushel dry measure.

277¼ Cubical inches, one gallon.

46656 Cube inches, one cube yard, or 27 cube feet, containing 21 bushels.

32 4/9 Feet cube, one hundred of lime.

1½ Hundred of chalk lime to one rod of brick-work.

1 Hundred of stone lime to one rod of brick-work.

2 Bushels of lime to one square of plain tiling.

VIII.—*Sand.*

18 Heaped bushels, 22 striked bushels, or one yard cube, one single load of sand.

36 Heaped bushels, 44 striked bushels, or two yards cube, one double load of sand.

3 Single loads of sand to one rod of brick-work with chalk lime.

3½ Single loads of sand to one rod of brick-work with stone lime.

1 bushel of sand to one square of plain tiling.

IX.—*Mortar.*

27 Cube feet, or 22 striked bushels, one load of mortar.

Half a hundred of lime with a proportionable quantity of sand, will make one load of mortar.

1134 Cube inches, or 8 duodecimal inches, one hod of mortar, a hod being 9 inches by 9 inches, and 14 inches long.

2 Hods of mortar to a bushel nearly.

2216¼ Cube inches, one bushel.

1728 Cube inches, one cube foot.

1 Foot three inches cube, one bushel.

4 Hods of mortar will lay 100 bricks.

180 Hods, or 96 bushels of mortar, to one rod of brick-work.

X.—*Roman Cement.*

1 rod of brick-work requires 68 bushels of cement.

1 Cubic yard of brick-work requires 6 bushels of cement.

1 Yard square of 14 inch. walling, 2¼ bushels of cement.

1 Yard square of 9 inch. walling, 1½ bushels of cement.

1 Yard square of 4 inch. walling, ½ bushel of cement.

1 Yard square of pointing to brick-work, ½ bushel of cement.

1 Yard square of plain surface in plaistering, ¾ bushel of cement.

XI.—*Slates.*

1 Ton of Westmoreland slates will cover 2 squares.

1 Ton of Welch rag will cover 1½ to 2 squares.

1000 Dutchess slates will cover 9 squares.

1000 Countess slates will cover 5 squares.

1000 Ladies slates will cover 3½ squares.

1000 Tavistock slates will cover 2¼ sqrs.

A square of Westmoreland, or Welch rag slating, will weigh 10 cwt.

A square of Dutchess, Countess, or Ladies slating, will weigh 6 cwt.

Welch slates, called—	ft. in.		ft. in.
Doubles, average	1 1	by	0 6
Ladies	1 3	–	0 8
Countesses	1 8	–	0 10
Dutchesses	2 0	–	1 0
Rags	3 0	–	2 0
Queens	3 0	–	2 0
Imperials	2 6	–	2 0
Patent Slates	2 6	–	2 0

XII.—*Gravel.*

27 Heaped bushels, one load.

A yard cube of solid gravel, containing 18 heaped bushels before digging, will produce 27 heaped bushels when dug.

XIII.—*Night Soil.*

18 Cube feet, one ton.

45 Cube feet, 2½ tons, being the quantity contained in each load, the carts being usually made 6 feet long, 3 feet 3 inches wide, and 2 feet 4 inches deep.

XIV.—*Carpenter.*

100 Feet superficial, one square of boarding, flooring, &c.

50 Cube feet, one load of timber.

40 Cube feet, one ton of oak timber.

120 Deals make one hundred.

1 Hundred (120) 12 feet 2½ inch. deals, 9 inches wide, equal to 4½ loads of timber, each deal containing 1 foot 10½ inch. cube.

1 Hundred (120) 12 feet 3 inch. deals, 9 inches wide, equal to 5 and two-fifth loads of timber, each deal containing 2 feet 3 inches cube.

XV.—*Weight of Roof Covering.*

1 Square pan tiling will weigh 7½ cwt.

1 Square plain tiling will weigh 14½ cwt.

1 Square Dutchess, Countess, or Ladies slating, will weigh 6 cwt.

1 Square Welch rag or Westmoreland slating, will weigh 10 cwt.

1 Square lead covering, 7 lb. to the foot superficial, will weigh 6¼ cwt.

1 Square copper covering, 16 ounces to the foot superficial, will weigh 1 cwt.

XVI.—*Weight of Materials.*

	tons.	cwt.
64 Cube feet of fir timber	1	0
39 Cube feet of oak	1	0
60 Cube feet of elm	1	0
45 Cube feet of ash	1	0
35 Deals, 12 feet long, 2½ inch. thick,	1	0
15 Cube feet of Portland	1	0
13 Cube feet of marble	1	0
20 Cube feet of chalk	1	0
56 Feet superficial of Purbeck paving	1	0
70 Feet superficial of Yorkshire do.	1	0
24 Cube feet of sand	1	0

	tons.	cwt.
18 Cube feet of earth	1	0
17 Cube feet of clay	1	0
36 Cube feet of water	1	0
450 Stock bricks	1	0
1000 Stock bricks	2	4
1 Rod of brick-work	13	0
1000 Plain tiles	1	1
1000 Pan tiles	2	2
100 Foot paving tiles	0	11
100 Ten inch paving tiles	8	7½
Bar iron, 1 inch square, weight, *per foot run,*	*lb.*	3½
Ditto, 2 inches square		13½
Ditto, 3 inches square		31
Ditto, 3½ inches square		42

XVII.—*Specific Gravity and Weight of Materials.*

	ounces.	lbs.	ozs.
1 Cube foot of water	1000 or	62	8
1 Cube foot of fir	550 or	34	6
1 Cube foot of elm	600 or	37	8
1 Cube foot of beech	700 or	43	12
1 Cube foot of maple	755 or	47	3
1 Cube foot of ash	800 or	50	0
1 Cube foot of oak	925 or	57	13
1 Cube foot of mahogany	1063 or	66	7
1 Cube foot of sand	1520 or	95	0
1 Cube foot of chalk	1793 or	112	1
1 Cube foot of common earth	1984 or	124	0
1 Cube foot of brick	2000 or	125	0
1 Cube foot of clay	2160 or	135	0
1 Cube foot of common stone	2500 or	156	4
1 Cube foot of flint	2570 or	160	10
1 Cube foot of marble	2705 or	169	1
1 Cube foot of granite	3500 or	218	12
1 Cube foot of green glass	3600 or	162	8
1 Cube foot of white lead	3160 or	197	6
1 Cube foot of cast iron	7425 or	464	1
1 Cube foot of wrought iron	7645 or	477	13
1 Cube foot of copper	9000 or	562	8
1 Cube foot of lead	11325 or	707	13

XVIII.—Sundries.

Linear or Running Measure regards only Length, but has no regard to the Breadth or Thickness.

12 Inches, one foot.
3 Feet, one yard.
5½ Yards, one rod or pole.
1760 yards, one mile.
5280 Feet, one mile.

Superficial or Square Measure regards the Length and Breadth.

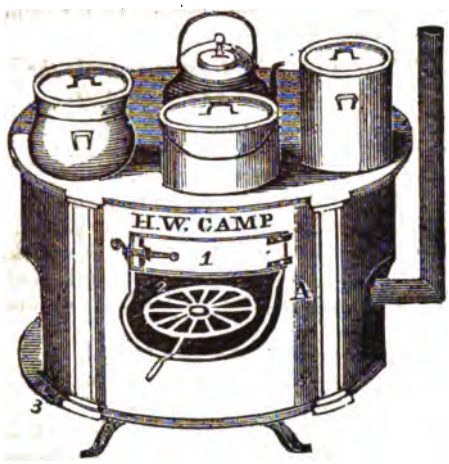
144 Square inches, one square foot.
272¼ Square feet, one square rod or pole.
43560 Square feet, or 4840 square yards, or 160 square poles, one square acre.
9 Square feet, one square yard.
100 Square feet, one square of flooring, tiling, slating, &c.

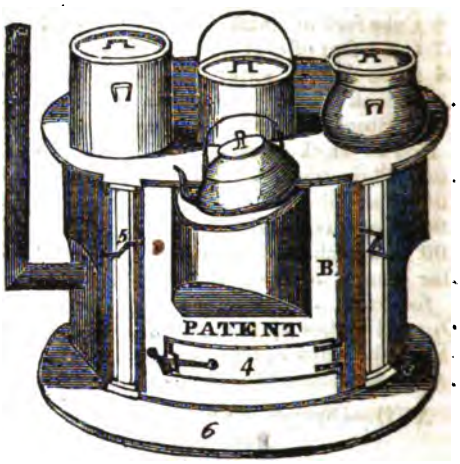
Solid or Cubical Measure regards the Length, Breadth and Thickness.

1728 Cube inches, one cube foot.
46656 Cube inches, one cube yard.
27 Cube feet, one cube yard.
34⅔ Cube inches, one pint dry measure.
277⅓ Cube inches, 8 pints, or one gallon.
554⅔ Cube inches, 2 gallons, or one peck.
2218⅔ Cube inches, 4 pecks, or one bushel.
17745⅔ Cube inches, 8 bushels, or one quarter.
1 Foot, 3 inches cube, one bushel.
10 Feet cube, one quarter of corn, &c.
277¼ cube inches, one gallon.
14971 Cube inches, or 8⅔ cube feet, in one hogshead of beer, containing 54 gallons.
13306 Cube inches, or 7¾ cube feet, in one hogshead of ale, containing 48 gallons.
17467 Cube inches, or 10⅛ cube feet, in one hogshead of wine measure, containing 63 gallons.
9981 Cube inches, or 5¼ cube feet, a barrel containing 36 gallons.
29943 Cube inches, or 17⅓ cube feet, a butt, containing 108 gallons.
1 Barrel of beer will weigh 367½ lbs., or 3 cwt. 1 qr. 3 lbs.
1 Butt of beer will weigh 1102 lbs., or 9 cwt. 3 qrs. 10 lbs.
1 Cube foot will contain 6 gallons and 1 pint of beer, or water, which will weigh 62½ lbs.
A bushel striked is to a 5 bushel heaped as 4 is to 5.
The least whole numbers that will form a right angled triangle, or make a square, are 3, 4, 5, or any multipliers of them, as 6, 8, 10, or 9, 12, 15, &c.
The breadth of paper for hanging rooms being twenty inches broad, therefore any number of superficial feet divided by five will give the number of yards of paper necessary to paper the room.

XIX.—*A Table showing the Weight per Foot Superficial of Lead, from one sixteenth of an Inch thick to one Inch thick.*

Thickness.	Weight per foot super.
1/16	3¾
1/15	5
1/14	6
1/8	7½
1/6	10
1/5	12
1/4	14¾
1/3	19¾
1/2	29½
3/4	44¼
1 inch	59





Camp's Patent Double Flue Cooking Stove.

To the Editor of the Mechanics' Magazine:

Dear Sir,—I have lately made what I deem an important improvement in the common cooking stove, and for which I have obtained a patent. The stove is known as H. W. Camp's Patent Double Flue Cooking Stove, and presents by far greater advantages to the economist than any stove of the kind heretofore offered to the patronage of the public.

References—A, front view; B, back view; 1, fire door; 2, gridiron on sunk hearth; 3, damper to flue under oven; 4, oven door; 5, cranks to dampers; 6, lower hearth.

This stove, as you will perceive by a reference to the engravings above, brings the fire immediately in contact with the vessels of various kinds which are used for cooking: the hearth on which the fire is placed being above the oven, and the whole top of the stove left to be occupied with the places for the different cooking utensils, and not in the least interfered with by the pipe of the stove, which is at one end. The draft of the stove divides in the centre when both dampers are up, passing to each end; at one end immediately into the pipe, and at the other end downwards, under the bottom plate of the oven, and, ascending at the opposite end of the stove, uniting with the other draft, and passing out of the pipe, thus imparting heat as well to the bottom and ends as to the top of the oven, or, in other words, completely surrounding the oven with heat by this arrangement of the fire and draft. There are, it will be perceived by the plate, two cranks at figs. 5; these turn, as may be desired, the dampers which close the flues, so that, while baking, the whole draft may be directed under the bottom of the oven by shutting down the damper at the end where the pipe is, and opening the other. By a reference to the engravings it will be seen that the hearth of the fireplace is so arranged as to admit of the coals from the fire being drawn out for the purpose of using a gridiron for broiling; the draft is so strong that the smoke goes into the stove while the broiling is going on. In closing these few remarks, I would observe that no apprehensions need be entertained about the smoke of the fire coming into the room, for with all the lids off not a particle will escape, it all passing off by the pipe.

With respect, yours, &c.

H. W. Camp.

Oswego, N. Y., Nov. 1, 1834.

Mechanism of Hearing.—The ear, properly so called, by its excavations, gathers the sonorous undulations, and directs them towards the auricular canal. In this first passage, the sound is united into a focus; and, for this reason, it augments in intensity; it follows the auricular canal, and soon reaches the membrane of the tympanum, to which it communicates its vibrations; this latter being thin, dry, elastic as the head of a drum, and consequently well calculated to repeat the sonorous waves, transmits them to the internal ear by three several means, namely, the chain formed by the *small bones;* the *walls of the cavity* of the tympanum, which are elastic; finally, and especially, *the air* which fills up this cavity. Then the membranes of the *foramen ovale* and *foramen rotundum*, and of the vestibule, which are dry and vibratory, like that of the tympanum, participate in the oscillations, and transmit them to the *lymph* of *Cotugno* contained in the different passages of the labyrinth. Finally, the humor presses vi-

bratory sonorous waves against the nervous expressions which float in its interior, and the impression which they receive is, lastly, transmitted through the acoustic nerve to the sensorium commune.

The experiments of Mr. Savart are a positive demonstration of the effect of the sonorous waves or undulations on the membrane of the tympanum.

Sound, sometimes, does not follow the course which we have just indicated. For instance, when stopping our ears, we still hear the ticking of a watch placed between our teeth; the sonorous undulations are then communicated by the bony structure of the cranium to the acoustic nerve—solids being, under certain circumstances, excellent conductors of sound.

Such is, in an abridged manner, the physical history of hearing; beyond this, we have no positive knowledge.

But physiologists wish to give more precision, and describe in a more special manner the part that each portion of the ear acts; we shall see, while examining the principal hypotheses, that they are far from having thrown any light on this phenomenon.

Dumas considers the membrane of the tympanum as being formed of concentric curved lines, which have the property of vibrating each in a particular tone; and others have advanced that the difference of tones results from the different degrees of tension of this membrane.

We have had under our care several individuals who were deaf, and in whom this membrane was wanting; but after the true cause of deafness was removed, the patients heard perfectly well every *tone* or spoken language, without having recovered the membrane of their tympanum. So that these facts do away these hypotheses of Dumas and others.

As to the small bones, it has been presumed that they strike on each other, or on the membrane of the tympanum only; hence their names of *hammer* and *anvil*. We conceive that such hypotheses do not deserve to be repeated. Besides the use which we have already assigned to them, it is generally admitted that they modify the degrees of tension of the *membrane of the tympanum*, and of the membrane of the *foramen ovale*.

Their anatomical structure, their articulations, their muscles intended to move them, are the best proofs of the movements they must perform, and of their being thus used.

Some physiologists have supposed that the *Eustachian tube* permitted sonorous undulations to pass, instead of being singly a passage for the air to enter into the cavity of the tympanum. This may be immediately disproved by placing a watch in the mouth so as not to touch any solid part, in which case the tick of the watch is not heard; but if the watch be permitted to touch the teeth, then it will be heard, and that through the continuous connection of solid bodies which are conductors of sounds.

What, you may ask, is the use, then, of these bones, and of the membrane of the tympanum? Why, you may also ask with propriety, should *nature* bestow upon our species so very delicate and complicated an apparatus, if we may hear just as well without it? We understand the import of such questions, and cannot deny their force; but we shall remain satisfied with the facts we have observed, and shall not try to explain what we conceive is, till now, above the comprehension of every human being.

The case of ——— ——, who had lost both the membranes of the tympanum, and all the small bones, as well as the case of Mr. ———, who also has lost the same parts, and both these individuals still hearing perfectly the human voice, or any other sound, are, to us, obvious proofs that the proper and indispensable part of the organ of hearing is the labyrinth and acoustic or auditory nerve.

This we observe to exist in some animals where there is no auricular or introductory tympanum, no bones of the cavity of the ear; but the undulations of the air are received at once on a membrane which communicates them to the labyrinth, and thus to the nervous expansions of the auditory nerve.

If, however, in man, or those animals which have a tympanum, the last bone of the series—the stirrup—is lost, the membrane covering the oval hole will be generally destroyed also; and as the fluid contained in the inner ear (*the lymph of Cotugno*) will, in consequence, escape, deafness will ensue, from the medium being lost, by which the immediate organ of hearing becomes affected. The same thing happens whenever the membrane of the round hole is destroyed.

The immediate function of the organ of hearing is, as we have already stated, to give us the sensation of sounds; but its mediate functions being more closely connected with, and serving more intimately, the mind, than those of taste or smell, has caused this organ to be placed on a par with touch and sight.

We may, in fact, by means of hearing, ascertain the nature of bodies, the situation they occupy, the distance at which they are placed, the direction in which they move,

&c. This sense, moreover, assists the intellectual faculties: those of *music* and *language*, for instance, without which they can no longer be exercised.

Metaphysicians, struck with its great utility, in the exercise of these faculties, have exclusively ascribed them to this organ.

There is a great deal of difference between that power of perception which constitutes hearing, and that which is connected with the appreciation of musical sounds; for if the faculty of combining sounds according to harmonic relations, and so as to constitute *music*, be the mere product of the sense of hearing, then this faculty ought to be possessed by all animals, and by every man, in the same ratio with the perfection of the structure of their ears. This, however, is not so. Many animals hear better than man, and, nevertheless, none possess the faculty of music to the same extent. No relation is observable, in animals, between the power and character of their music and the perfection of their hearing: for instance, the birds which do not sing have as nice an ear, with respect to mere hearing, and some even more, than the singing birds.

Again, among the singing birds, often the male alone has this instinct of pouring forth their strain. Many of these singing birds sing only at certain periodical seasons. Shall we say, in this instance, that they are all at once excited at this period, or periodically endowed with this faculty, and afterwards fall again into the same apathy, although the ear of these animals remain the same at all times?

The ear of all birds is nearly constructed on the same plan. They have no external ear or auricle; the cavity of the tympanum contains only *one bone* instead of *four*, as in man, and the cochlea is a cone slightly curved. Notwithstanding this very great similarity of structure, each one of them has preserved, ever since the creation, its peculiar note, or series of notes, and has acquired no others. There is, however, an exception in the mocking bird.

The elephant, which has a nicer apprehension of sounds than man, (as we shall prove it by an anecdote presently,) has no faculty whatsoever for music. The parrot, it is well known, can be taught to speak any language, and, of course, must have a very nice, discriminating ear; he, however, never sings, and the tones of his voice are far from being musical.

Finally, we do not see that, in man, musical talent or correct elocution is in the same ratio with the nicety of hearing. Men who have the most delicate hearing often cannot sing at all—Mr. Burke and Dr. Johnson are instances of it. Idiots, who hear very well, cannot learn how to sing the simplest melody, or utter spoken languages intelligibly. From these facts we are inclined to conclude that the faculty of music does not depend upon the organ of hearing solely, but is a superior intellectual endowment, for the acquisition of which the ear is merely a secondary instrument.

We might, with the same propriety, ascribe to the eye exclusively the faculty that painters have of executing historical paintings, or in any other style, as to attribute to the ear the power of music. Then every man would be a painter; but we know that some cannot even conceive what lines represent, intended to delineate an object.

The same is the case with spoken languages. If we suppose that animals have none, why then have they a hearing at all—to which metaphysicians ascribe also the faculty of language? Why, with the possession of this organ, they do not form a language like that of man, or something like it?

If, on the contrary, we suppose that they have a language: why, then, with an organ constructed always nearly on the same plan, are languages in animals so different—for each one has it peculiar articulations of sounds? It may be asked, how is it that man, with the same organ of hearing, has, in different countries, various languages and articulations? This is true, when he wishes to express abstract conditional ideas; but all men, however, use the same *tones* to express their passions or sentiments, which is in fact the natural language of man, as singing is the natural language of birds. Why has each of them its peculiar language? Finally, do we find that in man the faculty of spoken language is in the same ratio of the nicety of his hearing? Do we find that poets and orators have the best hearing? Idiots, with an exquisite nicety in hearing, can never learn how to speak or sing.

To us it is also certain that the faculty of spoken language is a superior intellectual faculty, for which hearing is, there is no doubt, an indispensable but secondary instrument, and destined solely to convey to the brain sonorous sensations, to which the latter alone connects ideas. Languages also follow the same progress as that of civilization, and of the ideas diffused and in circulation in a nation. Books are merely the depository of the march of mind. Oral language, and languages generally, like nations and empires, have their period of rudeness, of improvement, amelioration, and have also

the seeds of decay and degradation, keeping pace precisely with the improvement and decline of morals or sciences; for, being the result of society, they are *man* himself, manifested in his moral capacity by these external sounds or signs. It is the index of his character and calibre of his mind; his speech or style must unquestionably unfold his cast of mind and manners, and paint the high or low origin of his sentiments. A man's works are the mirror of his soul. The more a man or nation extends his relations, the richer his language becomes; the more, also, the individuals speaking it will become polished and learned. The same is the case with respect to a deaf and dumb subject who has recovered his hearing: every new subject with which he becomes acquainted, he naturally acquires a new dictionary of words and phrases in proportion to the acquisition of the number of his new ideas. A stationary language like the Chinese informs us, as clearly and as evidently as if we were reading the pages of its history, that its government, manners, religion, laws, sciences, and arts, are also perfectly stationary. See, on the contrary, the revolution produced in the French language by the *political* revolution of '92. Then, we may conclude, that languages are so truly the creation of the mind, that in every nation, as in individuals, they are in strict relation with the number and character of their ideas and opinions, or, in other words, they are the true index of their mind; that it is correct to say, that the amount of a man's knowledge is equal to his language; and it is equally correct to say, with Charles the Fifth, that an individual is as many times a man as he speaks different languages. Therefore, a deaf and dumb is scarcely a man. Oral language without society cannot exist in man; for all individuals who have been found wild in the forest, although their parents spoke some one known oral language, still they imitated simply the sounds of the animals which they frequented and daily heard. Monkeys, which resemble man in many respects, are not endowed by our Creator with the faculty of speech; and this faculty, more than any other perhaps, distinguishes man from every other animal. Thus, man alone speaks; for as to the sounds uttered by parrots, it cannot be said that they speak a language, since we know that they attach no ideas to the sounds to which they give utterance; and this, in our minds, is another proof that, to possess the mere *oral organ*, as in the case of the parrot, or the few words that the deaf and dumb may utter, is not sufficient to say that the individual can *speak* and *think* in that language. Idiots, although they have the *oral organs* perfect, cannot speak, because they want the moving power—the mind. Also, that whenever a nation has acquired many ideas, its language becomes rich in proportion, and in consequence of it. Thus, Italy, among modern nations, who, when other nations of Europe had scarcely a language, had a most beautiful and perfect one—rich in every mode of expression; she had also, so far back, distinguished poets, and legislators, statesmen, and philosophers; celebrated historians; painters, sculptors, architects, and musicians; great captains; mariners, the conqueror of a new world; discoverer of the mariner's compass; merchants, who exchanged the productions of the west with those of the eastern hemisphere; who have first established banks, bills of exchange, and post-offices; who first established a militia system, tactics of warfare, fortifications, and internal improvements. And, to use the language of the poet,

> "Birthplace of heroes, sanctuary of saints,
> Where earthly first, then heavenly glory made
> Her home; thou all which fondest fancy paints,
> And finds her prior vision but portray'd
> In feeble colors, ——————."

But, to return. If an individual have a strong mind, thinks profoundly, and feels deeply, his language partakes of the grandeur of his thoughts, and he speaks warmly, cogently, and energetically. If, on the contrary, he wants ideas and affections, he is silent, or if he speaks at all, he is insipid, flat, and his language is devoid of any coloring.

Although the hearing of man has a great degree of perfection, still this sense, in many animals, seems to be even richer in its discrimination, if we may be allowed especially to judge, in certain cases, by the size of the nerve, and the greater developement of the whole organ in advance.

The ears of animals offer a great variety of structure in their details. Indeed, we observe this structure to be from the existence of a mere sac, having apparently no nervous pulp on it, up to the complicated apparatus such as we have demonstrated in man.

There is every reason to suppose, that, as some small animals have microscopic eyes, and possess a power of vision far beyond what is necessary to us, or what we are capable of exercising, there is also, in many, a minute and accurate appreciation of sounds, of which we can form no conception, not until we shall find microscopes and telescopes for our ears.

Our knowledge of the comparative acuteness in the auditory faculty of animals is not very extensive. The elephant, however,

is said to be endowed with a remarkably acute sense of hearing. Its auditory organs, it is true, are larger than in other animals, or man himself; and Sir Everard Home, while dissecting its ear, discovered that the membrane of the tympanum was muscular. Mr. Corse, who saw much of the habits of the elephant in India, states that a tame elephant, which was never reconciled to have a horse moving behind him, although he expressed no uneasiness if the horse was within his view, either before or on one side, could distinguish the sound of a horse's foot at a distance, some time before any person in company heard it. This was made manifest by his pricking up his ears, quickening his pace, and turning his head from side to side.

He also mentions a tame female elephant, which had a young one, that was occasionally sent out with other elephants without the young one being allowed to follow. She was not in the habit of pining after it, unless she heard its voice; but frequently on the road home, when no one could distinguish any sound whatever, she pricked up her ears and made a noise expressive of having heard its call. This having occurred frequently, attracted Mr. Corse's notice, and made him, at the time the female elephant used these expressions, stop the party, and desire the gentlemen to listen; but they were unable to hear any thing till they had approached nearer to the place where the young one was kept.

We shall in this place remark, that we are able to determine the power of hearing by the distance at which a given sound, used as a standard, may be heard; this refers merely to the intensity of the sound, but we have no means of determining as to the tone and timbre, no more than we can ascertain if we all see the same color, possessing the same hue. We have, in fact, no means of ascertaining if all animals perceive, if not the same *tone*, at least the same *timbre*. It appears from some observations of Dr. Wollaston, that some persons are insensible to various sharp sounds, as the chirp of the house sparrow, and house cricket, the squeak of a bat, and the noise of small insects, without having any other defect in the organ.

We have had under our care two young ladies, who could hear, on the contrary, when at a distance, the voice of a bird, while at the same distance they could not hear the noise of a cart, or hear thunder itself.

If a different organization of the gustatory and olfactory nerves have made persons perceive different odors and tastes in the same substance, or smell one odor and not be able to smell another, why should not a different organization of the acoustic nerve make us perceive also different *timbres* in the same sonorous body, or hear one kind of sound and not others? But this is impossible either to prove or to deny. These remarks especially apply to the differences we find in the sense of hearing of various men.

These differences arise also from, 1st, the intimate structure of the acoustic nerve; 2d, the more or less perfect structure and disposition of the parts in advance of the nerve; and 3d, to the hygeinic precautions necessary to keep the organ in a fit state for the exercise of its functions.

Hearing is one of the senses which most enlarge our intelligence; and like all the other senses, it may acquire power and perfection by practice, and we may exercise it passively or actively, that is to say, we may *hear* or *listen to*.—[From Dr. Togno's Treatise on the Laws of Acoustics.]

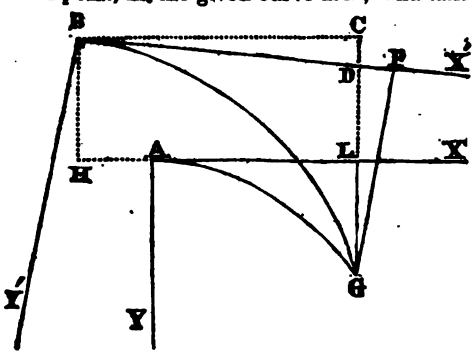
On the Location of Railroad Curvatures; being an Investigation of all the Principal Formulas which are required for Field Operations, in laying Curves and Tangent Lines, to pass through Given Points. By J. S. Van De Graaff. [From the American Railroad Journal.]

(Continued from page 304.)

22. Let two curves be under consideration having different origins, and tangent lines; and let one of those curves be given, and a point designated therein, through which the other curve is required to pass. Take a system of rectangular co-ordinate axes, corresponding with the given origin, and tangent line, of the given curve, and let the co-ordinates of that point which is designated for the required curve to meet be x, y; the value of these co-ordinates being computed by means of (VII.) if the given curve be already laid in the field, but determined by means of a system of rectangular lines when that curve has not been actually laid. Let the co-ordinates of the *new origin*, taken with reference to the axes of x, y, and determined either by computation or by means of a system of rectangular lines, be denoted by $\propto$ β; $\propto$ *being supposed to coincide with the axis of* x. And lastly, take z to denote the given inclination of the tangents at the origins of the two curves. From those data it is then proposed to find the modulus of curvature of the required curve, such that it may pass through the designated point.

Take a new system of rectangular co-ordinate axes, corresponding with the origin and tangent line of the required curve; and agreeably to these, let x', y', represent the new co-ordinates of the point designated in the given curve. It is then very obvious that the required modulus of curvature will be immediately derived from (XI.), when the new co-ordinates x', y', become known. The value of those co-ordinates must therefore be sought

agreeably to the known methods of analytical geometry, for the transformation of co-ordinates. Let A be the origin, and G the designated point, in the given curve AG; and take



the point B for the new origin of the required curve BG, and AX, AY, and BX', BY', for the two given systems of rectangular co-ordinate axes; the two tangent lines coinciding with AX and BX' respectively. Let such lines be drawn as appear obvious upon the figure, and the following values will then obtain: $x = AL$, $y = LG$, $\propto = AH$, $\beta = HB$, $x' = BP$, $y' = PG$, and $z = \angle CBD = \angle LGP$.

By plane trigonometry $CD = \overline{x + \propto} \cdot \text{Tan. } z$; and consequently $DG = y + \beta - \overline{x + \propto} \cdot \text{Tan. } z$; but again by plane trigonometry, $PG = DG \cdot \text{Cos. } z$. Hence, $PG = \overline{y + \beta} \cdot \text{Cos. } z - \overline{x + \propto} \cdot \text{Sin. } z$. In like manner it will be found that $BP = \overline{y + \beta} \cdot \text{Sin. } z + \overline{x + \propto} \cdot \text{Cos. } z$. The values of the new co-ordinates will therefore be expressed as follows:

$$x' = \overline{y + \beta} \cdot \text{Sin. } z + \overline{x + \propto} \cdot \text{Cos. } z$$

$$y' = \overline{y + \beta} \cdot \text{Cos. } z - \overline{x + \propto} \cdot \text{Sin. } z. \quad \text{(XXI.)}$$

Such are the formulas to be used in the field, when a new system of co-ordinates must be computed; they are the well known expressions given by most authors for the transformation of rectangular co-ordinates, and they only here stand transposed in such a manner as will best suit the engineer's purpose in the present inquiry.

It may be observed, that the value of the angle z need never be obtained by a measurement with the instrument; for it may always be easily computed from the manner in which the two origins, at A and B, have been obtained.

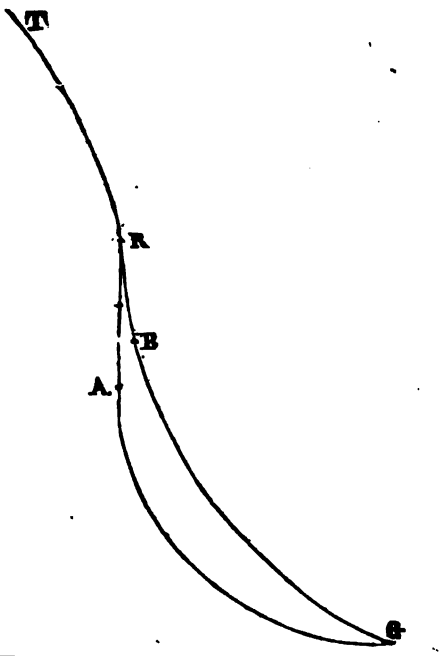
The value of the new co-ordinates having been found, the required modulus of curvature may be easily computed by means of (XI.) as before remarked. But a direct formula will be more convenient for use; and in order to obtain such a formula, let each of (XXI.) be squared, and the result will give $x'^2 + y'^2 = \overline{y + \beta}|^2 + \overline{x + \propto}|^2$. Hence denoting the required modulus of curvature by T', the following formula will be immediately derived from (XI.)

$$\text{Sin. } T' = \frac{\overline{y + \beta} \cdot \text{Cos. } z - \overline{x + \propto} \cdot \text{Sin. } z}{\overline{y + \beta}|^2 + \overline{x + \propto}|^2}. \quad \text{(XXII.)}$$

The theorem thus obtained, expressing the value of T', has a very good form for numerical computations, and when skilfully applied, it will frequently save much labor in the field, which would be otherwise required when *certain alterations* are proposed in a line *once computed, or accurately traced.* And although the co-ordinates $\propto$, β, and the angle z, which expresses the inclination of the axis of x, and of x', to each other, will change their *signs* under different circumstances in the field, yet, to those who are familiar with the use of algebraic formulas, this cannot be a source of any embarrassment. For it has only to be observed that the hypothesis here assumed is, that $\propto$ is accounted *positive* when its direction is immediately *opposite* to the direction of x; and β is, in like manner, accounted *positive* when its direction is immediately *opposite* to the direction of y. And either $\propto$ or β must, in consequence, have its sign *reversed* in (XXI.) or (XXII.), when the circumstances in the field are such as to give either of them the same direction with its respective co-ordinate axis.

The angle z is to be accounted negative, or which is the same thing, the quantity Sin. z must have its sign *reversed*,* in the two following cases: I. When β is positive, and the two tangents diverge *in advance.* II. When β is negative, and the two tangents converge *in advance.* In all other cases the formulas (XXI.) and (XXII.) will retain their present forms, as far as the angle z is concerned.

In order to show *one* case in which an application of (XXII.) will be extremely convenient in practice, let TRS be a curve already laid in the field upon *such ground as ought to be se-*



* *Note.*—Agreeably to the principles of trigonometry, when an arc becomes negative, the Sine becomes negative also; but the Cosine does not change its sign.

lected, and let SA be a *short* tangent intervening between the given curve TRS, and a certain reversed curve AG, necessary to pass a designated point G. Having traced a system of rectangular lines from the given origin A, and terminating in the designated point G, let the modulus of curvature be computed by means of (XI.) which would trace the curve AG, and let the direction of that curve, at the point G, be examined agreeably to the method explained in Article 16. Now, supposing this curvature is found more abrupt than is thought to be judicious, the only method of alteration will be to take the curve TRS off into a tangent a little sooner, as for instance at the station R, and then a new origin will be obtained at B, in the new tangent RB, for the required curve BG, which is the very case under consideration in the present article. The inclination of the two tangents RB and SA, will be known at once from (IV.); and the co-ordinates of the new origin B may be easily computed by methods to be hereafter explained. By repeating a calculation from (XXII.) for several points in the given curve TRS, it will be easy to select a proper point R, at which to terminate the given curve TR, in order to lay a short tangent RB in such a position as to meet the necessary conditions imposed by the reversed curve BG. Other cases will be hereafter mentioned, in which an application of (XXII.) will be required; but, in the first place, the following examples are here given, amply to illustrate the *various mutations of that formula, under the different circumstances occurring in practice.*

Example 1. Let figures 1 and 2 exhibit the relative positions of the origins and tangent lines in two *different instances* occurring in the field; A being the primitive origin in both figures. Suppose a system of rectangular lines to be traced from the origin A, and terminating in the designated point G, and let the resulting equations give, $x = 17$ chains, $y = 12$ chains, agreeably to the principles explained in Art. 16. Take also the co-ordinates AH and HB, of the *new origin*, equal to 3 and 2 chains respectively, and let the inclination of the new tangent BX′ be 10°, *converging* in advance.

Fig. 1.

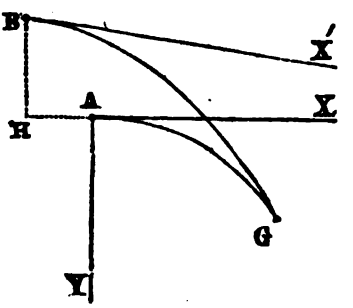
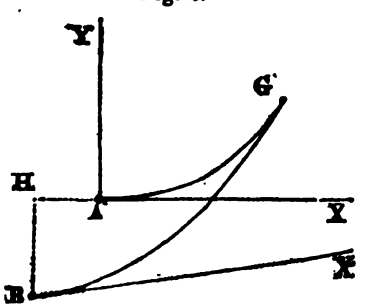


Fig. 2.



In this case, either figure being under consideration in the field, the following values will obtain, viz.: $\alpha = +3$, $\beta = +2$, and $z = +10°$. Hence,

$$\text{Sin. } T' = \frac{\overline{12+2} \cdot \text{Cos. } 10° - \overline{17+3} \cdot \text{Sin } 10°}{\overline{12+2}|^2 + \overline{17+3}|^2}$$

$$= \frac{14 \cdot \text{Cos. } 10° - 20 \cdot \text{Sin. } 10°}{196 + 400} =$$

$$\frac{14 \times \cdot 98481 - 20 \times \cdot 17365}{596} =$$

$$\frac{13{\cdot}787734 - 3{\cdot}47300}{596} = \frac{10{\cdot}31434}{596}$$

$= {\cdot}01731$; or, $T' = 0° 59\frac{1}{2}' =$ modulus of curvature necessary to trace a curve *from the new origin* B to the designated point G.

Example 2. Let the relative positions of the *origins* in two other instances be the same as in figures example 1; and suppose the two tangents to *diverge* in advance.

Here, retaining the same quantities given in the first example, the signs which appertain equally to fig. 1 and fig. 2 are the following, viz.: $\alpha = +3$, $\beta = +2$, and $z = -10°$. And, therefore, in this case,

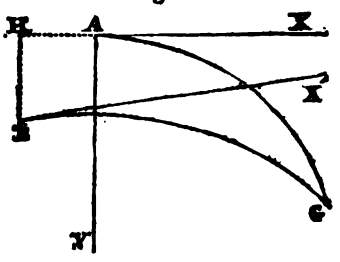
$$\text{Sin. } T' = \frac{\overline{12+2} \cdot \text{Cos. } 10° + \overline{17+3} \cdot \text{Sin. } 10°}{\overline{12+2}|^2 + \overline{17+3}|^2}$$

$$= \frac{13{\cdot}78734 + 3{\cdot}47300}{596} = \frac{17{\cdot}26034}{596} = {\cdot}02896;$$

or, $T' = 1° 39\frac{1}{2}' =$ modulus of curvature required.

Example 3. Let the relative positions of the origins and tangent lines be such as is indicated by figures 3 and 4, the primitive origin being

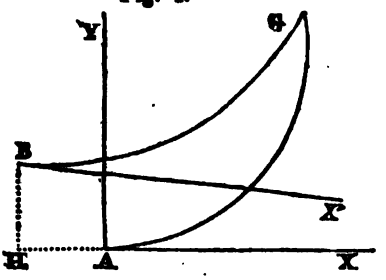
Fig. 3.



represented at A, as before, and the tangents AX, BX′, *converging* in advance. It is evident that the same signs will appertain to both of the figures 3 and 4; that is, $\alpha = +3$, $B = -2$, and $z = -10°$. And therefore in this case,

$$\text{Sin. } T' = \frac{\overline{12-2} \cdot \text{Cos. } 10° + \overline{17+3} \cdot \text{Sin. } 10°}{\overline{12-2}|^2 + \overline{17+3}|^2} =$$

Fig. 4.



$$\frac{10\times\cdot98481+20\times\cdot17365}{100+400}=\frac{9\cdot84810+3\cdot47300}{500}=\frac{13\cdot32110}{500}=\cdot02664\text{; or, } T'=1^\circ\,31\tfrac{1}{4}'=\text{modulus of curvature,}$$

which would trace either of the curves, in figure 3 or figure 4, from the *new origin* B to the designated point G.

Example 4. Suppose the relative position of the *new origin* to be such as is represented by figure 3, or figure 4; and let the two tangents AX and BX′ *diverge* in advance.

Taking the signs which appertain to this case, the following values will obtain: $\propto = +3$, $B = -2$, and $s = +10^\circ$; and consequently

$$\text{Sin. } T'=\frac{\overline{12-2}\cdot\text{Cos. }10^\circ-\overline{17+3}\cdot\text{Sin. }10^\circ}{\overline{12-2}|^2+\overline{17+3}|^2}=\frac{9\cdot84810-3\cdot47300}{500}=\frac{6\cdot37510}{500}=\cdot01275\text{; or, } T'=0^\circ\,43\tfrac{1}{4}'=\text{new modulus of curvature}$$

which would be required in either of the figures 3 or 4, upon the supposition that the tangents AX and BX′ *diverge* in advance.

Example 5. Let figures 5 and 6 show the relative positions of the origins and tangent lines, as occurring in two different instances; the tangents being represented *converging* in advance.

Fig. 5.

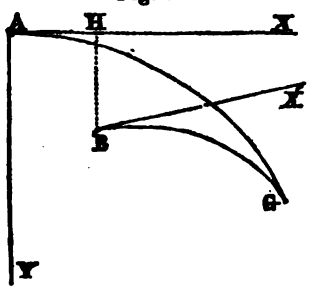
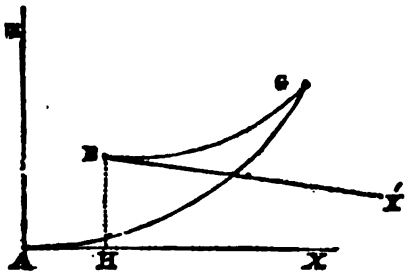


Fig. 6.



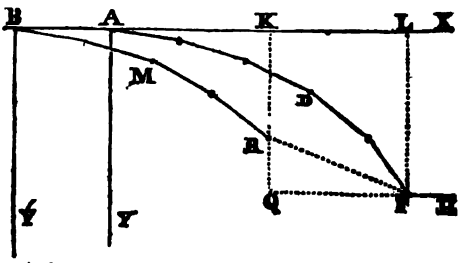
Here the following values will obviously obtain with reference to either of the figures 5 or 6; that is, $\propto = -3$, $B = -2$, and $s = -10^\circ$. Therefore,

$$\text{Sin. } T'=\frac{\overline{12-2}\cdot\text{Cos. }10^\circ+\overline{17-3}\cdot\text{Sin. }10^\circ}{\overline{12-2}|^2+\overline{17-3}|^2}=\frac{9\cdot84810+2\cdot43110}{296}=\frac{12\cdot27920}{296}=\cdot04148\text{,}$$

or, $T' = 2^\circ\,22\tfrac{1}{4}' =$ required modulus of curvature.

The preceding examples do not exhibit all the mutations which will sometimes occur in (XXII) —but are sufficient to explain the principle. The importance of that formula in the field rendered such explanations necessary, in order that those persons who may not be already familiar with that elementary principle of analytical geometry, may nevertheless be enabled to compute without perplexity or liability to error.

23. Suppose ADF to represent a given curve, and BMR another proposed curve laid upon the same tangent line AX, and let $\propto$ denote the given distance AB, between their origins. Take T and T′ to represent the given moduli of curvatures, and n, and m, the given number of chains contained in each curve respectively. It is required to determine the distance FR, between the extreme stations of those two curves; and it is also proposed to show a method by which the instrument may be directed into the line FR, from the extremity of the given curve ADF.



Take two systems of rectangular co-ordinate axes, AX, AY, and BX, BY′, corresponding with the common tangent line AX, and whose origins coincide respectively with the origins A and B of the two curves. Taking x, y, to denote the co-ordinates AL, LF, of the extremity of the given curve ADF, their values will be either known from (VII.), or determined in the field by means of a system of rectangular lines. Let x', y', be the co-ordinates, BK, KR, of the extremity of the proposed curve BMR, as estimated agreeably to the proper axes BX, BY′. The differences, KL, RQ, of co-ordinates, will then be expressed by $x+\propto-x'$, and $y-y'$, respectively. Hence, taking w to denote the distance sought, the common principle of analytical geometry gives the following formula:

$$w=\{\overline{x+\propto-x'}|^2+\overline{y-y'}|^2\cdot\}^{\frac{1}{2}}\quad\text{(XXIII.)}$$

And thus the distance w becomes known; for the values of the co-ordinates x', y', will be expressed as follows:

$$x' = \frac{\text{Sin. } 2mT'}{2 \text{ Sin. } T'}$$

$$y' = \frac{1 - \text{Cos. } 2mT'}{2 \text{ Sin. } T'}.$$

Now, in order to determine a method of directing the instrument into the line FR, when placed at the given station F, let FH be a line whose direction is parallel to the axis of x, and whose position is in *advance* of the station F, with reference to the origin A, upon the axis AX. The instrument may then be directed into the line FH, either by means of (IV.), or by the principles contained in Art. 16, agreeably to the circumstances of the case. Take, therefore, the letter P, to denote the angle of position HFR; and when its value has been computed, by a method which will be presently shown, deflect the angle HFR = P, and the instrument will indicate the required direction FR. And thus the position of the station at R will be seen at once, without actually tracing the proposed curve BMR.

The value of the angle P is now to be investigated. By plane trig. Rad.: Sin. QFR :: FR : RQ; and, also, Rad. : Cos. QFR :: FR : FQ. That is, Sin. QFR $= \frac{y - y'}{w}$, and Cos. QFR $= \frac{x + \propto - x'}{w}$. But, agreeably to the principles of trigonometry, Sin. P = Sin. QFR, and Cos. P = — Cos. QFR. Hence the following formulas are the obvious result:

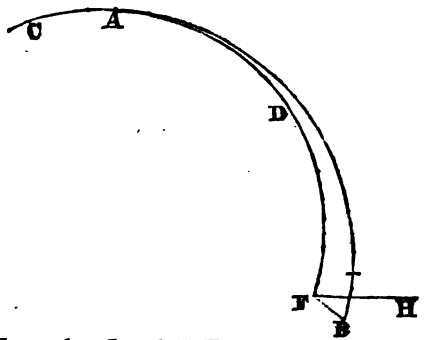
$$\text{Sin. P} = \frac{y - y'}{w};$$

$$\text{Cos. P} = \frac{x' - x - \propto}{w}. \qquad \text{(XXIV.)}$$

It will require a reference to both of the expressions (XXIV.), to determine the magnitude of the angle P, although one of them will be sufficient in finally making the computation. In this inquiry, the *signs* of the various quantities must be particularly observed in the following manner.

The quantity $\propto$ is considered positive when the given origin A is in *advance* of the proposed origin B; and consequently, *in a contrary case*, the quantity $\propto$ must have its sign *reversed* in (XXIII.) and (XXIV.). The angle P is supposed to be measured from the station F, and from the line FH, in a direction increasing from *right to left*, with reference to the line FH, through all four of the quadrants. By observing this principle, the position of the line FH, under all circumstances, will be immediately known from the *signs* of the quantities Sin. P and Cos. P. Thus, when Sin. P and Cos. P are both positive, the line FR will be situated in the first quadrant; when Sin. P is positive, and Cos. P negative, then is the line FR posited in the second quadrant; when Sin. P and Cos. P are both negative, then will the line FR fall in the third quadrant; and lastly, when Sin. P is negative, and Cos. P positive, then will the situation of the line FR be found in the fourth quadrant.

The following example will illustrate the utility of (XXIII.) and (XXIV.)



Example. Let CADF be a curve already traced from a modulus of curvature of 2° 30′, and let A be a station in that curve 30 chains from the extreme station at F. Supposing a change of curvature to be made at A, such as to trace the curve AR, for a distance of 30 chains, from a modulus of curvature of 2° 28′, it is proposed to know how far those two curves would be separated from each other at their extremities; and it is also required to designate a line immediately from the extremity of the given curve, as already laid, to the point where the proposed curve would terminate.

In this case, then, $\propto = o$, $n = w = 30$, $T = 2° 30'$, and $T' = 2° 28'$. Hence, $2mT = 150°$, $2mT' = 148°$; and therefore, by (VII.),

$$x = \frac{\text{Sin. } 150°}{2 \text{ Sin. } 2° 30'} = \frac{\cdot 50000}{\cdot 08724} = 5 \cdot 731; \quad y = \frac{1 - \text{Cos. } 150°}{2 \text{ Sin. } 2° 30'} = \frac{1 + \cdot 86603}{\cdot 08724} = \frac{1 \cdot 86603}{\cdot 08724} = 21 \cdot 389;$$

$$x' = \frac{\text{Sin. } 148°}{2 \text{ Sin. } 2° 28'} = \frac{\cdot 52992}{\cdot 08608} = 6 \cdot 156; \quad y' = \frac{1 - \text{Cos. } 148°}{2 \text{ Sin. } 2° 28'} = \frac{1 + \cdot 84805}{\cdot 08608} = \frac{1 \cdot 84805}{\cdot 08608} = 21 \cdot 469.$$

Wherefore, $x + \propto - x' = 5 \cdot 731 - 6 \cdot 156 = - \cdot 425$; $y - y' = 21 \cdot 389 - 21 \cdot 469 = - \cdot 080$; and $w = \overline{|- \cdot 425|^2 + |- \cdot 080|^2}^{\frac{1}{2}} = \overline{\cdot 1806 + \cdot 0064}^{\frac{1}{2}} = \overline{\cdot 1870}^{\frac{1}{2}} = \cdot 436$ of a chain = required distance FR. In this example, the position of the line FH, which is parallel to a tangent at A, must be obtained agreeably to the method explained in Art. 11; and then, Sin. P $= \frac{y - y'}{w} = \frac{- \cdot 080}{\cdot 433} = - \cdot 1848$; Cos. P. $= \frac{x' - x - \propto}{w} = \frac{+ \cdot 425}{w}$. Here, Sin. P is negative, and Cos. P positive; and consequently the angle P falls in the 4th quadrant; that is, from Sin. P = — ·1848, I find, P = 349° 21′, which is the value of the *exterior* angle HFR; and therefore deflect the *interior* angle HFR equal to 10° 39′, and the instrument will then show the required direction of the line FR.

MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING DECEMBER 13, 1834. [NUMBER 6.

History of Astronomy—its various Systems, &c. [Concluded from page 266.]

OF THE QUANTITY OF MATTER IN THE SUN AND PLANETS, AND THE FORCE OF GRAVITY AT THEIR SURFACES.—On first view it almost appears impossible to determine the respective masses of the sun and planets, and to measure the height from which bodies fall in a given time, by the action of gravity at their surfaces. But the connection of facts with each other often leads to results which appear inaccessible when the principle on which they depend is unknown.

It was therefore perfectly natural, even for astronomers, to consider it impossible to determine the intensity of gravity at the surfaces of the planets, while the principle of universal gravitation remained unknown;* and it is just as natural for those who are unacquainted with mathematics and astronomy to consider the same thing impossible, even although they have heard of such a principle as universal gravitation. We shall therefore state what has been the result of the calculation of some of the first rate astronomers of the present day on this curious and interesting subject.

From the fact that action is always accompanied by re-action, astronomers conclude that gravitation among terrestrial bodies is the mutual tendency of the particles of matter to one another; and, from analogy, they think it perfectly reasonable to suppose that this is true in all cases; and that the force of gravitation towards different bodies, the distance being the same, is proportional to the quantities of matter, or the masses of the bodies.

This supposition is the foundation of all the calculations respecting the masses of the planets; and from it formulas have been deduced, for calculating the relative quantity of matter in such of the primary planets as have satellites revolving round them; but the quantity of matter in those that have no satellites can only be guessed at by the effect they produce in disturbing the motions of the other planets.*

The quantity of matter in the moon, however, may be determined by comparing its influence with that of the sun in producing the tides, and the precession of the equinoxes. By these means it has been ascertained that the mass of the moon is about one seventieth part of that of the earth; and La Place, in his *Mecanique Celeste*, has determined the quantity of matter in each of the primary planets, from the most exact data, to be as follows:

Quantity of matter in the Sun	1
Mercury - - -	$\frac{1}{\text{illegible}}$
Venus - - -	$\frac{1}{\text{illegible}}$
The Earth - - -	$\frac{1}{\text{illegible}}$
Mars - - -	$\frac{1}{\text{illegible}}$
Jupiter - - -	$\frac{1}{\text{illegible}}$
Saturn - - -	$\frac{1}{\text{illegible}}$
Uranus† - - -	$\frac{1}{\text{illegible}}$

The masses of the planets being known, and their bulks being also known, their densities are easily determined, for these are proportional to the masses divided by the bulks.

La Place, taking the mean density of the sun as *unity*, finds the density of such planets as have satellites to be as follows: The Earth, 3·9395; Jupiter, 0·8601; Saturn, 0·4951; Uranus, 1·1376.

Knowing the masses of the planets and their diameters, the force of gravity at their surface may be determined; for, supposing them to be spherical, and to have no rotation on their axes, the force with which a body placed on their surface gravitates to them will be proportional to their masses divided by the squares of their diameters. From the masses of Jupiter and the Earth, La Place calculates that a body which weighs one pound at the earth's equator, if carried to Jupiter's equator would weigh 2½ pounds, sup-

* It was this discovery which rendered it practicable to measure the intensity of gravity at the surfaces of the planets.

* The quantities of matter in any two primary planets are directly as the cubes of the mean distances at which their satellites revolve, and inversely as the squares of their periodic times.

† By adding these fractions together, it will be found that the quantity of matter in all the planets together is not one six-hundredth part of the matter in the sun!

posing these bodies to have no rotation, and supposing the weights to be measured by the pressure exerted in the two situations. If the same body were carried to the surface of the sun, it would weigh about $27\frac{3}{4}$ ponnds; from which it follows, that a heavy body would there descend about 444 in the first second of time.

Although all the planets gravitate to the sun, yet the centre of the sun is not the centre of gravity of the whole solar system. The centre of the sun is, however, never distant from that point so much as his own diameter, consequently the centre of gravity of the whole system is always within the body of the sun. But as this point and the centre of the sun do not coincide exactly, and as the gravitation of the planets to the sun must be accompanied by the gravitation of the sun to the planets, from the quality of action and re-action, it follows that the sun must have a motion in a small orbit round the centre of gravity of the whole system. The form of this orbit is however very complicated, on account of the disturbing forces of so many planets, which are sometimes exerted towards one side, and sometimes towards another; and even unequally exerted on different sides at the same time, according to the situation of the planets in their orbits.

Thus we see the extraordinary and universal principle called gravitation has not only been the means of making us acquainted with a great number of inequalities in the motion of the heavenly bodies, which it would have been impossible to have discovered by observation, but it has furnished us with the means of subjecting these motions to precise and certain rules.

The motion of the earth, which had obtained the assent of astronomers, on account of the simplicity with which it explained the celestial phenomena, has received a new confirmation, which has carried it to the highest degree of evidence of which physical science is susceptible. Without the knowledge of this universal principle, the ellipticity of the planetary orbits—the laws which the planets and comets obey in their revolution round the sun—their secular and periodical inequalities—the numberless inequalities of the moon, and the satellites of Jupiter—the precession of the equinoxes—the mutation of the earth's axis—the motions of the lunar axis—and the ebbing and flowing of the sea,—would only be insulated facts, and unconnected phenomena. It is, therefore, a circumstance which can scarcely be sufficiently admired, that all these phenomena, which at first sight appear so unconnected, should be explained by *one principle*—that of the mutual gravitation of all bodies with forces directly as their quantities of matter, and inversely as the squares of their distances.

Of the principal Systems of Astronomy.—After the description which has been given of the various phenomena of the heavens, both as viewed with the naked eye and the telescope, it may not be unnecessary, nor unacceptable to the reader, to give a short account of the principal theories or systems which have been formed at various periods to account for some of these appearances, and particularly for the apparent motions of the celestial bodies.

The explanation of the celestial motions which naturally occurred to those who began the study of the heavens, was, that the stars are so many luminous points fixed in the surface of a sphere, having the earth in its centre, and revolving on an axis passing through that centre, in the space of twenty-four hours. When it was observed that all the stars did not partake of this diurnal motion in the same degree, but that some were carried slowly towards the east, and that their paths estimated in that direction, after certain intervals of time, returned into themselves, it was believed that they were fixed in the surfaces of spheres which revolved westward more slowly than the sphere of the fixed stars. The spheres were supposed transparent, or made of some crystalline substance, and from this arose the name of the crystalline spheres, by which they were distinguished. Though this system grew more complicated as the number and variety of the apparent phenomena increased, yet it was the system of Aristotle and Eudoxus; and, with few exceptions, of all the philosophers of antiquity.*

But when the business of observation came to be regularly pursued, little was said, either of the fixed stars or of the crystalline spheres; astronomers being chiefly bent on ascertaining the laws or general facts connected with the motions of the planets.

To do this, however, without the introduction of hypotheses, at this period, was scarcely possible. The simplest and most natural hypothesis was that the planets moved eastward in circles, at a uniform rate. But when

* Although it is said that Pythagoras taught that the earth was a planet, and that the sun was fixed in the centre of the planetary system, that the apparent revolution of the heavens was produced by the diurnal revolution of the earth, and that the apparent annual motion of the sun was occasioned by the earth moving round him like the other planets, yet this doctrine was never taught publicly, and in a very short time it was completely forgotten.

it was found that, instead of moving uniformly to the eastward, every one of them was subject to great irregularity, the motion eastward becoming slower at certain periods, and at length vanishing altogether, so that the planet became stationary, and afterwards acquiring a motion in the contrary direction, and proceeded for a time to the westward, it was far from obvious that all these appearances could be reconciled with the idea of a uniform circular motion.

The solution of this difficulty is attributed to Apollonius Pergæus, one of the most celebrated mathematicians of antiquity. He conceived that each planet moved in a small circle, and that the centre of this small circle moved in the circumference of a large circle, which had the earth for its centre. The first of these circles was called the *epicycle*, and the second the *deferent*; and the motion in the circumference of each was supposed uniform. Lastly, it was conceived that the motion of the centre of the epicycle in the circumference of the deferent, and likewise the motion of the planet in that of the epicycle, were in opposite directions, the first being towards the east, and the second towards the west. In this way the change from progressive to retrograde, as well as the intermediate stationary points, were readily explained.

But, notwithstanding the accomplishment of this important object, no regular system of astronomy appears to have been framed or taught by any individual till the appearance of the celebrated Ptolemy, who has always been reckoned the prince of ancient astronomers, not so much on account of being the founder of the system which goes by his name, as for the number of observations which he made, and the extent of his astronomical writings.

As we have already given an account of this, as well as the Tychonic and Copernican systems, at page 189, vol. ii., we shall conclude this subject by giving a short description of the Cartesian system.

Cartesian System.—The founder of this system, Rhene Des Cartes, flourished about the beginning of the 17th century. He supposed that every thing in the universe was formed from very minute bodies, called *atoms*, which had been floating in open space. To each *atom* he attributed a motion on its axis, and he also maintained that there was a general motion of the whole universe, round like a *vortex*, or whirlpool. In the centre of this vortex was the sun, with all the planets circulating round him at different distances; those that were nearer the sun circulating faster than those at a greater distance, as the most distant parts of a vortex or whirlpool are known to do. Besides this general vortex, each of the planets had a particular vortex of its own, by which its satellites, if it had any, were whirled round, and any other body that came within its reach.

This is the celebrated system of vortices, invented by Des Cartes. The fabric, it must be confessed, is raised with great art and ingenuity, and is evidently the produce of a lively fancy and a fertile imagination. But then, it can be considered only as a philosophical romance, which amuses without instructing us, and serves principally to show that the most shining abilities are frequently misemployed.

In this hypothesis, Des Cartes supposes extension to constitute the essence of matter, and wholly neglects *solidity*, as well as the *inertia* by which it resists any change in its state of motion or rest, which principally distinguishes body from space; and consequently, the doctrine of an universal plenum, deduced from this definition, is founded upon false principles.

That there is such a thing as a vacuum in nature, or a space void of body, may be demonstrated from various experiments. By means of the air pump, we can so far exhaust the air from a glass receiver, that a piece of gold and a feather, let fall together from the top of the vessel, shall both descend equally swift, and come to the bottom at the same time: which evidently shows, that the air being taken away, there remains no other matter sufficient to cause any sensible resistance, or that in the least impedes or obstructs their passage.

It was said by many of the ancient philosophers, that nature abhors a vacuum; and by means of this dogma, and others of a like nature, they attempted to prove and illustrate the doctrine of an universal plenum, like that of Des Cartes. But this is an assertion, unsupported by facts, and too idle a notion to require any formal refutation; and in nearly the same predicament are most of the other arguments which have been used in defence of this doctrine. They are all sufficiently exposed, not only by the Torricilian experiment, and the nature of pumps in general, but likewise from the most obvious phenomena of the constant and free motion of bodies, whether celestial or terrestrial, which come continually under our inspection.

On the system of Des Cartes, and all others that depend on the same principle, we may remark, that if the planets be carried round the sun in vortices, the quantity of matter in the sun cannot affect the velo-

city of the vortex, or the bodies immersed in it; consequently the velocity might be the same, though there were no central body whatsoever. The quantity of matter in the sun, therefore, cannot have the least effect in retaining the planets in their orbits. But the quantity of matter in the sun does not affect the planet, and is a material element in its gravitation towards the centre of its orbit. It is therefore impossible that the action of a vortex can have any effect whatever upon that gravitation. This argument is perfectly conclusive and fatal to the system of vortices; but we may observe, that this system owed its downfall to another argument, equally, if not still more powerful—namely, that whenever you suppose the vortex so arranged that it will explain one of those great facts in the planetary motions, known by the name of Kepler's Laws, it becomes quite inconsistent with the rest.

The vortices of Des Cartes have, therefore, ceased to afford any satisfaction, even to the most superficial reasoner, and are now only known in the history of opinions, in which they will ever furnish a most instructive chapter.

[From the Journal of the Franklin Institute.]

Report on Mr. Peck's Method of Propelling Boats.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the mechanic arts, to whom was referred for examination a Plan of Propelling Boats, invented by Mr. J. Peck, of Oakland, Jefferson county, Tennessee, report—

That the inventor proposes to employ what he terms a *multiplied crank*, attached to an axis made to revolve horizontally by some power not indicated in the sketch before us. The several wrists of the compound crank are to have either setting poles or hooks attached, one to each wrist, which poles or hooks are to act successively in urging the boat forward, by applying, when poles are used, to the bottom of the canal or stream, and when hooks are substituted, to a rack, or rope, extending the whole way on the shore. Coiled springs are to be placed in some part of each pole, to prevent the effect of sudden and violent impulses. When the pole is used to apply to the bottom, a species of foot, made of three or four strips of metal, attached by hinges to the lower end of the pole, are to spread out and present a large surface to the soft bottom of the stream, to avoid sinking deep into the mud.

The slight sketch in the hands of the committee does not show any provision for guiding and directing the poles, nor obviate the difficulty from unequal depths on the two sides of the boat, when poles are used on both sides.

The method appears less suited to a railway than the rack-rail already in use, in connection with toothed wheels, to insure the advancement of locomotive engines.

It seems unlikely that this plan will supersede the more simple methods already used for propelling boats, unless under very peculiar circumstances, and with some arrangements for obviating the practical difficulties which are not indicated in the sketch before us. By order of the committee.

WILLIAM HAMILTON, Actuary.

March 13, 1834

Report on Mr. B. Dugdale's Wind-Mill.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the mechanic arts, to whom was referred for examination a Horizontal Wind-*mill*, invented by Mr. B. Dugdale, of Burlington, N. J., report—

That the machine in question consists of an upright shaft revolving on a pivot in a step at its lower end, from which shaft, near its upper extremity, proceed, in one horizontal plane, ten equidistant arms; and from near the middle of the same shaft, proceed ten corresponding arms, also in one horizontal plane. Between each pair of corresponding arms, oblong rectangular frames of wire are hung, (at the extremities of the arms,) in such a manner as to admit of a horizontal vibration, through an arc of about ninety degrees. To these frames the sails are attached by small rings of wire, which can slide up and down the vertical bars of the frames.

The operation of raising the sails is performed by means of cords, one of which is attached to the stretcher at the upper end of each sail, and passes through a pulley at the extremity of the upper arm, along that arm to the shaft, and down the shaft to a collar sliding on the same. When this collar, to which all the cords are attached, is depressed on the shaft by means of a lever, all the sails are raised simultaneously. Again, when the collar is elevated, the cords become slack, and the sails drop by their own weight.

The vibratory motion allowed to the frames which support the sails, is so regulated that the sails on one side of the shaft present their surface to the wind while those on the opposite side offer their edges only: the ef-

ficiency of the machine is due to this arrangement.

Your committee deem it unnecessary to expatiate upon the merits of this wind-mill, or to discuss the patentee's claim to originality in his invention; but will merely refer all who are interested in the subject to the Repertory of Arts, and to the Edinburgh Encyclopædia, in which they will find described several mills operating upon the same principle, some of which closely resemble this one in the details of their construction. By order of the committee.

WILLIAM HAMILTON, Actuary.

March 13, 1834.

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Report on Mr. Smith's Compass Needle.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the mechanic arts, to whom was referred for examination an Improved Compass Needle, manufactured by Mr. —— Smith, of Washington City, report—

That they have examined the needles submitted to them for that purpose by Mr. Trotter, together with the pamphlet of Mr. Smith, entitled "An Improvement," &c. and the notice of the patent for this improvement in the Journal of the Franklin Institute.

The claims in regard to the needles appear to be—

1. To a method of magnetizing them by percussion with what is called an electric rod.

2. To the removal of the influence of irregular magnetic distribution, and of local attraction, by "shifting feeders."

In regard to the particular method used by Mr. Smith, of conferring magnetism by percussion, the committee have no precise information, the needles not having been presented for their examination by the inventor himself, and no adequate description having been published of the details of his method. The general fact is well established in science, and testimony from various quarters speaks well of the application of it by Mr. Smith. Respecting the efficacy of the small pieces of soft iron, termed "feeders," shifting upon the magnet, and usually placed near the poles, the committee inquired and refer to the subjoined experiments for the data upon which their opinion has been formed. In these experiments they avail themselves of the kind assistance of Prof. Henry, of Princeton, who was, at the time they were making them, on a visit to our city.

The first object was to ascertain whether the feeders added to the intensity of the magnetic force in the needle.

For this purpose, the needle, furnished with its feeders drawn out to the marks on the ends, was suspended by a bundle of fibres of raw silk, free from twist. It was placed over a divided circle, that its deviation from the magnetic meridian might be observed. Drawing it out of that meridian it was made to vibrate, and the vibrations noted, when they had diminished so as to reach a certain extent. The mean of one hundred and twenty vibrations gave for the time of ten vibrations 80·47 seconds.

The weight of the magnet furnished to the committee was, without the feeders, 532·1 grains. The feeders weighed together 13·9 grains.

For these iron "feeders," two pieces of brass, of nearly the same weight and form, were substituted, that the mass of the needle might remain the same; the brass pieces were placed in the position formerly occupied by the feeders, and the needle was then vibrated.

The brass feeders were lighter than the iron ones by ·1 grain. From two series of experiments of one hundred and twenty each, the time of performing ten vibrations in this latter case was 79·87 seconds.

By the well known law expressing the relative horizontal intensities of the magnetism in these two cases,—namely, that the forces are inversely as the squares of the time of vibration,—the intensity in the first case was to that in the second as $79{\cdot}87^2$ to $80{\cdot}47^2$, or as ·98 to 1.

The force of the magnet, instead then of being increased by the feeders, is slightly diminished by them. Your committee must observe here, that it seems to them that this result is what should have been expected from placing a piece of soft iron within the poles of the magnet.

The next point to be examined was the efficacy of the "feeders" in preventing the effects of local attraction. This might be inferred from the results just given, but the committee preferred to subject it to direct experiment.

The same needle before used was placed upon a steel point, fixed in the centre of a graduated circle. A mass of soft iron was brought to a measured distance from the needle, when the "feeders" were on; the deflection produced was noted; the "feeders" being removed, the deflection produced by the same mass in the same position was ascertained. These experiments the committee did not consider susceptible of the

same nicety which was used in the first inquiry. The piece of iron was a rectangular plate, nineteen and three eighths inches long by six and three eighths wide, and weighing twenty-four pounds. The following results were obtained, and may be considered to approximate within about one quarter of a degree of the truth.

When the iron plate was placed with its longest side making an angle of about forty degrees with the axis of the needle,—the least distance from the south pole of the needle, six inches,—with the "feeders" on, the deflection was 18¾°; with the brasses on, the deflection was 19°. The plate was now brought to half the distance above stated: With the "feeders" on, the deflection was 31¼°; with the brasses on, 31¾°.

The proportional difference in the deflections with the feeders on and off, is, in the first case, one in seventy-six, and in the second, one in about sixty-four. These numbers are to be considered as merely approximate, but they serve to show that the needle is less deflected with the "feeders" on, than when they are off, a result agreeing with the conclusions to be derived from the first experiments, which showed that the magnetism was weakened by the "feeders." If the magnetism had been entirely destroyed, the deflection would have been nothing. The needle subjected to experiment was, in fact, a very weak magnet, and the feeders made it still more feeble.

In the Transactions of the Irish Academy for 1788, a plan is proposed "to preserve the magnetism, and consequently the *polarity*, of the needle," by having it "cased with thin, well polished, soft iron, or else to have it armed at the poles with a bit of soft iron." Capt. O'Brien Drury, by whom this suggestion was made, modestly submits his invention to the judgment of those who are qualified to appreciate its merits, and we conceive that this judgment may be considered to have been formed by the neglect of the invention during the forty-six years which have elapsed since its publication. In the plan before the committee, the needle is not entirely cased, but is furnished with shifting bands of soft iron.

By order of the committee.

WILLIAM HAMILTON, Actuary.

March 13, 1834.

Report on Mr. W. Henderson's Chart of Commercial Weights.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the mechanic arts, to whom was referred for examination a Chart of Commercial Weights, submitted by Mr. William Henderson, of Philadelphia, Penn., report—

That this chart comprises scales of comparison of the weights of the principal commercial cities of Europe, and other parts of the world.

Scales of the ancient weights of France and Holland, being those most generally referred to in books of science, are also given.

On the left of the scale the names of the countries or cities are printed, and also the denomination of weight into which the scales are divided, as pound, rotoli, kilogrammes, &c. &c.

The divisions on the scales are numbered at every ten.

For facilitating the comparison of weights of different countries, meridional lines are drawn across the scales at convenient distances.

Where different weights are used in the same country, different scales are for the most part given, as in the United States of America, one scale is given of pounds troy, and another of pounds avoirdupois. The troy scale extends from 0 to 219 pounds, and the avoirdupois scale from 0 to 179 pounds; and, within this compass, the comparison of weights of different countries is made by taking equal distances on the respective scales, from 0, or from the nearest meridional line, to the weights given and required.

The committee are of opinion that the chart of Mr. Henderson will be found useful in commercial establishments, but would recommend that the meridional lines should be made to correspond with definite divisions of the avoirdupois scale, as by that arrangement the comparisons could be made by a simple inspection of the chart.

By order of the committee.

WILLIAM HAMILTON, Actuary.

April 9, 1834.

WORMS IN THE BLOOD.—Dr. Bushman, a respectable surgeon of the Dumfries Dispensary, has published a remarkable account of a boy under his immediate care, eight years old, whom he bled in consequence of a severe pain in the head; and in the blood taken from the patient's arm, *fifteen worms* were discovered. They varied from half an inch to eight lines in length. The body was articulated, and had seven joints. It was the opinion of Mr. Rhind, a naturalist, that they corresponded in color, size, and structure, to the *Tipula oleracea*, which is found in ditch or river water.—[Scientific Tracts.]

We insert the following communication with much pleasure, as it refers to a subject which has been frequently treated of in this Journal. It will, we hope, elicit further information from American engineers, and we again call upon them to furnish us with the result of their reflections and investigations. —[Ed. R. J.]

On Railroad Undulations. By John Thomson, Civil Engineer, Nashville, Tenn.

To the Editor of the Railroad Journal.

Experiments have been made on the Liverpool and Manchester Railroad, by Mr. Badnall and others, for the purpose of showing the advantages of undulations on railroads. These experiments, and the results attempted to be deduced from them, are well known to engineers. The principles which Mr. Badnall attempts to deduce from these experiments have been considered visionary by many practical and scientific men. The question has attracted greater attention in England than in this country. The system has found its supporters and its opponents, who not unfrequently have employed ridicule and sarcasm instead of cool and rational argument.

It must be confessed, that the experiments above alluded to are not satisfactory. They seem to prove too much; as we ought to conclude from many of those experiments, that a car passing over an undulating road would acquire an additional velocity at every undulation, and would thus be moved by a kind of accelerating force as long as the undulations continued. The results of the experiments also are not sufficiently uniform, and indicate something defective in the mode of making the experiments. We may add, also, that Mr. Badnall has not been successful in his theoretical deductions. We may quote for example the following:

"Let P be the pressure or weight of a given body resting on a horizontal plane, and let S be the quantity taken off that pressure, (or let it be the diminution of pressure,) when the body is placed on an inclined plane, and let a be the angle of inclination with the horizon; we then have in *all cases*

S : P : : height : base.

But, height : base : : tang. a : 1

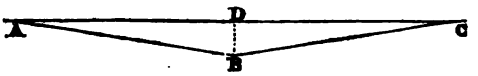
therefore, S : P : : tang. a : 1

consequently, S = P tang. a."

That this conclusion is erroneous may be shown by supposing a body of a given weight to be supported on an inclination of 45 deg. In that case we have tang. $a = 1$, and consequently the above equation becomes S = P, that is, the diminution of pressure is equal to the whole weight of the body, and therefore the body rests on the plane without pressure upon it, which is manifestly an error.

But, notwithstanding, there is enough in the experiments of Mr. Badnall, and in the nature of the subject generally, to invite the attention of engineers. That a body may be passed from one point to another, in the same horizontal plane, along a descending and an ascending path, in a shorter time than another body, moving in a straight horizontal line, and impelled at first by the same horizontal force, is true in theory, and no mathematician would controvert a principle so well known in mechanics. But whether the same will hold in practice, where the resistance of friction and of the atmosphere, &c. are to be taken into consideration, remains a question.

In further remarking on this subject, we shall adopt particular examples, which will perhaps answer the purpose of the present investigation better than a more general method.



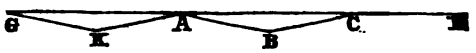
Let A B and B C be two inclined planes, meeting at the point B, and suppose the length of each to be 954 feet, the height B D 9 feet, the descent will therefore be 1 in 106, or 50 feet in the mile nearly. The distances along the inclined planes C B A, and along the straight line C D A, will be nearly the same, and equal to 1908 feet. Put g = force of gravity, f = any other accelerating force, t = time, v = velocity, and s = space.

Suppose a body at C to pass from C to B by the force of gravity, without resistance of any kind from friction, &c. the time of descent will be $t = \sqrt{\frac{2s}{f}} = 79{\cdot}2$ seconds, and the time in passing along the two planes C B, B A, will consequently be 158·4 seconds, supposing the angle at B slightly rounded. It is evident that the body at C may be removed in this way from the point C to A, without the application of any other force than that of gravity. Let us now suppose the body to be removed from C to A along the straight line C D A. To do this, either an impulsive or an accelerating force will be necessary, the force of gravity, of course, not acting in this direction. To find the amount of accelerating force that will move the body from C to A along the straight line, in the same time that it passes along the inclined planes, we have $f = \frac{2s}{t^2} = {\cdot}152$.

If we assume the weight to be removed 100 tons, the above force, compared with the force of gravity, will be expressed by 1057 pounds. This will be the accelerating force necessary to overcome the vis inertiæ of the above weight, so as to move it in a straight line from C to A, in the same time that it would pass by the force of gravity along the inclined planes. If we assume the resistance of friction of rail cars equal to the 240th part of the weight, the friction from a weight of 100 tons will be 933 lbs. Hence it is evident, that to overcome for the above space and time the vis inertiæ of a train of cars weighing in all 100 tons, it will require a greater force than that necessary to overcome the resistance of friction.

Let us now assume a case in practice: suppose two trains of cars to pass by locomotive power from C to A, one train along the inclined planes, the other along the horizontal plane A D C. Here a variety of accelerating and resisting forces are to be taken into consideration, and compared together, as they operate on each roadway. The resistance of friction may be considered the same on the level and on the inclined planes, since the pressure on an inclined plane, and consequently the friction, is as the cosine of inclination; and as the angle of inclination in the present case is very small, its cosine approaches very nearly to unity. The resistance of the atmosphere may also be considered nearly equal in both cases; at least, in practice, the difference is probably of little consequence. In regard to the resistance of inertia, the inclined plane has the advantage of the horizontal; as, on the former, it may be considered as overcome by the force of gravity. There is one resisting force operating on the inclined planes, which does not exist on the horizontal. It results from a change of direction from C B to B A; but as we have supposed the angle at B to be rounded, the only resistance will arise from an increase of pressure, and consequently of friction, in passing over the curve at B. Let us suppose the whole line C B A to be a circular curve, D B and D C the co-ordinates which are given. The radius of curvature will then be 50566 feet. And supposing an average velocity of 20 miles per hour, we have $f = \frac{v^2}{R} = \cdot 017$. If the weight moved be 100 tons, the above force, compared with the force of gravity, will be expressed by 118 lbs. This will be so much *additional weight* in passing the curve, and consequently the *additional* resistance of friction will be about one half pound. It is evident, therefore, that this resistance may also be neglected in comparing the advantages and disadvantages of the inclined and horizontal planes.

Let us now suppose the train of cars that move along the inclined planes to be propelled by a force of steam just sufficient to overcome the resistance of friction, atmosphere, &c. In that case we may suppose the whole mass to move (as in theory) without resistance, and by the force of gravity alone. The train would therefore move from C to A in 158 seconds, as above shown. But the same force of steam would not be sufficient to move the train along the horizontal plane, as the resistance of inertia for a given space and time was shown to be greater than that of friction. A slow progressive motion might be given to the cars by a small increase of the force of steam, but it would require more than double the force necessary to overcome friction, in order to move the train along C D A, in the same time with the train moving along C B A. It should also be observed, that the velocity acquired in passing along C D A in 158 seconds, is nearly 16½ miles per hour, when the velocity of a locomotive may generally be considered as nearly uniform. It is evident, therefore, that for the distance and inclination here supposed, and for *initial* movements, one concave undulation, (if it may be so called,) has the advantage of a straight horizontal surface.



Again, let us suppose a case in which a number of undulations may be taken into consideration. Let two bodies be supposed to move with equal and uniform velocities along the horizontal plane from E to C, one then passing along the inclined planes C B, BA, AK, the other passing along the horizontal line C G, the bodies moving without resistance from friction, &c. Assume the length and inclination of the planes the same as before, and let the initial uniform velocity from E to C be taken for example, $v = 6$, or 4 miles per hour nearly. Then, having f and s given, to find the time of passing down the inclined plane C B, we have $\frac{1}{2} f t^2 + v t = s$, from which $t = 61 \cdot 9$ seconds.

Hence the time in which the body passes along the two inclined planes C B A, will be 123·8 seconds. But the body moving along the horizontal plane C A, with the uniform velocity above given, will pass from C to A in 318 seconds, almost three times greater than the time of passage on the inclined planes. Now, suppose the angle at A to be

rounded, the body which moves along the inclined planes will pass the point A with the same original velocity with which it first started at E, because nothing has occurred to destroy that velocity. Hence it follows, that the body will pass the second equal concave undulation A K G in the same time it passed the first, and so on for succeeding undulations. It appears also that the *mean* velocity along the inclined planes, of the length and height already given, is nearly three times greater than that along the horizontal plane, the original impulsive force having acted *equally* on both bodies. It follows also that the mean velocity along the inclined planes, for a given number of undulations, is a constant quantity, and not an accelerated velocity. It is evident, also, that if the inclined planes had been reversed, that is, if C B had been an ascending plane from C, instead of a descending one, the motion of the body, moving along the inclined planes, would have been retarded in the same ratio that we have seen it accelerated; and hence the advantage of increased velocity is only gained by having the inclined planes below the general horizontal plane.

The above being true in *theory*, the question now presents itself—will the same principles hold in practice? It would seem, on a general view of the subject, that the action of the impelling and resisting forces, as they occur in practice, could scarcely be so *unequal* as entirely to destroy the advantages of inclined planes of moderate length and height. If models may be considered as giving any thing like correct ideas of practical operations, (and it must be confessed they are not always to be relied on,) any one may satisfy himself of the general truth of increased velocity, as above stated, by simply propelling two small rollers, of equal dimensions, with the same impulsive force, one to pass along a horizontal plane, the other along an undulating surface, which may easily be prepared for the purpose.

It is not at all inconsistent with the principles of dynamics, but in perfect accordance with them, that two bodies may be impelled horizontally with the same motive force, and yet one pass between two given points in the same horizontal plane in less time than the other body moving in a straight line. It is true, that a straight line between two points given in space is the line of quickest passage, when a single given force acts alone; but in the present question, two principal forces are always supposed to act —the motive force and the force of gravity.

In practice, the action of the force of steam is not always regular. When the piston has acquired a very rapid motion, the actual pressure of the steam in the cylinder becomes less, not so much from a difference of pressure in the cylinder and boiler, as from the fact, that steam is not generated with sufficient rapidity to keep up the usual pressure in the boiler. Hence it is, that when a locomotive passes down an inclined plane, the actual motive force of the steam will be lessened, when a very rapid velocity has been acquired near the foot of the plane. But it is altogether probable that, on planes varying from 800 to 1200 feet in length, and of an inclination of about 50 ft. in the mile, the average force of steam would be abundantly sufficient to pass a loaded train over a concave undulation, in less time than it would pass the same distance in a horizontal line, if we suppose the force of steam sufficient to give the train a velocity of 10 or 12 miles per hour on a *level* road.

But, in all cases in practice, care should be taken to adjust the length and height of undulations, so that the velocity acquired at the foot of the planes should not be greater than what might be deemed safer under all circumstances.

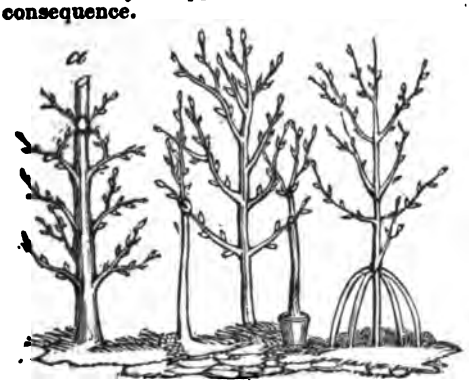
Upon the whole, *gentle* undulations, where the ground will permit, seem to be well calculated for steam or horse power. Much may be saved in the expense of grading, and water will always be prevented from lodging on the roadway.

In locating the planes for undulations, care should be taken so to adjust them, that a car, in passing over them, may first descend, and then ascend to nearly its former level. The nature of the ground in all places frequently permits this; for instance, in crossing a ravine, or small creek bottom, where the length of the planes may be from 100 to 300 yards. When it is necessary to extend the length of the planes to half a mile, or more, it is evident that the ascending and descending grades should be so adjusted, that the force of steam alone, and not momentum, may be depended upon, for passing the load up the ascending plane.

GRAFTING.—We copy the following from Prof. Rennie's little work on Scientific Gardening.

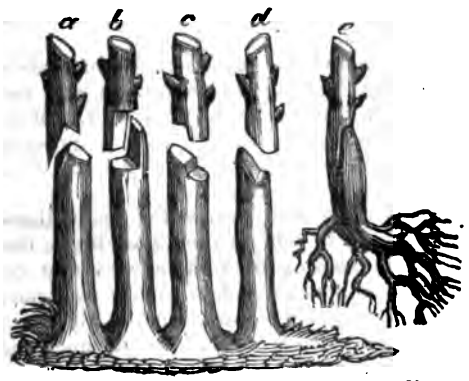
Grafting by Approach, or In-Arching.—This is to grafting what layers are to striking, the graft-slip not being cut off, but taken from a plant growing near the stock upon which it is suffered to remain till the joining is completed. Mr. T. A. Knight employed this mode, not only for the purpose of filling up from itself the parts of a wall-tree deficient in bearing wood, (*a*,) but also of improving the quality of fruits. It might be advantageously used in a similar way

to fill up the gaps in quickset and other hedges, where beauty of appearance is considered of consequence.



Examples of In-arching.

Slip, or Scion Grafting.—The slips taken off from one plant and joined to another, have the parts to be joined cut in various manners, according to the sort of plant, the size of the parts, and other circumstances. These will be better understood from the following figures, than from mere verbal description.



a, *b*, *c*, *d*, chink, or shoulder grafting; *e*, root grafting.

a, whip grafting with a peg; *b*, side grafting; *c*, whip grafting with a tongue, or tongue grafting; *d*, side grafting.

Professor Thouin has enumerated about fifty methods of grafting, but they all depend upon the same principles as already explained,

Bud Grafting, or Budding.—Instead of a slip, or scion, the bud of one plant may be so inserted into the bark of another as to grow, and produce branches, flowers, and fruit. It is requisite for this purpose that a leaf bud, known by its tapering sharp point, be selected, and not a flower-bud, known by its bulging and rather blunt point. It is necessary that the leaf connected with a bud be cut off, otherwise it would soon exhaust the sap, and the bud would wither and die. It is also necessary that the bark separate freely, which is the test for there being pulp enough to form a joining. When the bud is inserted, it must be tied round with a riband of bass, to exclude the air. Fine rose standards are thus formed.

Herb Grafting.—Though grafting is usually confined to trees, De Candolle thinks all plants may perhaps be capable of being so treated, and Baron de Tschoudy has in this way succeeded even with annual plants, as well as with the soft young shoots of trees; but it is necessary to success to have it performed near to or at the inner base of a living leaf, which serves to attract the sap.

In the case of plants with succulent leaves, it has been asserted, on authority, that "the union is imperfect," from the adhesion being "by the cellular substance" only, "no woody matter" being transmitted to the stock. That this is quite erroneous is shown by the striking instance of a Cactus truncatus grafted on a Cactus triangularis in the king's garden at Neuilly, as beautifully dissected and drawn by M. Turpin. This also equally disproves the common opinion that the graft in such cases is merely kept alive by the moisture supplied by the stock, and would do as well if stuck into a potato or a piece of moist sponge. It certainly furnishes a strong disproof of the baseless theory that maintains buds and grafts to send down woody matter to the stock, as roots descend into the soil.

Apparatus for analysing Marl, and the Carbonates in General. [From the Farmers' Register.]

William and Mary College, June 27, 1834.

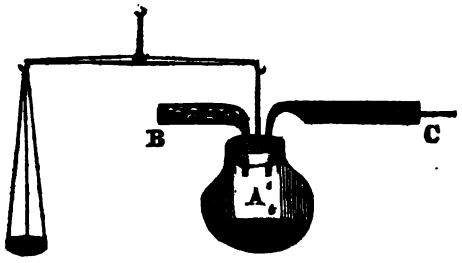
The apparatus which I am about to describe is intended to give greater accuracy and facility to the usual process for determining the quantity of carbonic in marl, or in any of the carbonates. By the common method, the two vessels containing severally the marl and the muriatic acid are placed in one of the scales of a delicate balance, and there counterpoised by weights put into the other scale. The acid is then poured upon the marl, and, after all the carbonic acid has been discharged, the equilibrium is restored by adding weights to one, or abstracting them from the other scale. In principle, this method is entirely free from objection, but as usually conducted, it cannot be relied upon as accurate. This want of precision arises in the first place from

the escape of aqueous vapor, along with the carbonic acid which is discharged, thus making a greater weight necessary for restoring the equilibrium than is due to the quantity of carbonic acid which has escaped —and secondly, from the greater weight of the vessels containing the marl and acid impairing the sensibility of the balance, and thus rendering it impossible to estimate the carbonic acid to small fractions of a grain. The first of these objections has long been obviated in the chemical analysis of the carbonates, by causing the gas as it escapes to pass through a tube containing dried muriate of lime; and the latter has been in some measure removed by a contrivance of the great practical chemist Rose; which, however, as it is inconvenient and uncertain in the manipulation, I shall not here describe.

The apparatus which I have devised is, I think, free from these objections, and enables the operator to proceed with great accuracy and despatch. It has the advantage of being very easily constructed, and of being used with a balance that can be procured at a very moderate price. Moreover, the quantity of marl which is necessary for experiment in no case exceeding ten grains, specimens for analysis may very easily be forwarded by letter.

The balance which I use with this apparatus is a small goldsmith's balance, such as may be procured for a few dollars in New-York. It is very light, and turns, when unloaded, with the one hundredth of a grain. My set of weights, obtained from Millington, in Philadelphia, extends to tenths and hundredths of the grain.

The accompanying figure will convey a distinct idea of the apparatus and mode of using it. One of the scales is removed, to admit of suspending the apparatus by a double thread over the hook of the beam. The other is made of something light, as a piece of card. In this way all unnecessary weight upon the beam is avoided, and its sensibility preserved.



A is a light bulb of glass, blown very thin, from a common piece of tube, and about one inch in diameter. A cork is fitted to its mouth, and through this the tapered ends of the bent glass tubes, B and C, are passed air tight; the extremity of the latter extending some distance into the vessel. The tube B, through which the gas escapes, is filled with fragments of muriate of lime. The tube C, which contains the muriatic acid, is furnished with a light piston of cork or cotton, in the centre of which is fixed a rod or handle, made of a small stiff straw. This instrument, when charged with marl and acid, does not weigh more than 120 grains. The whole load of the beam is therefore 240 grains, and it is still sensible to the one hundredth of a grain.

The mode of proceeding with the analysis is as follows. Five or ten grains of the finely powdered marl is introduced into the vessel A, and then two or three drops of water added, to assist the diffusion of the acid. The small end of the tube C, now removed from the cork, is dipped into some muriatic acid in a wine glass, and the piston moved backwards and forwards until the necessary quantity of acid has been drawn in. The tube is then replaced in the cork, and in this state the instrument is counterpoised by weights in the opposite scale. The piston being then gradually forced in, the acid is injected drop by drop upon the marl, and the gas escapes by the tube B, depositing the aqueous vapor in its passage on the muriate of lime. Allowing the apparatus to rest until the gas has entirely escaped, and the decomposition is complete, the equilibrium is restored by placing weights upon the clear top of the cork, or by removing weights from the scale. In this way the weight of the disengaged gas is accurately determined, and the proportion of carbonate of lime thence computed.

An analysis of a specimen of marl from James City, just completed, will serve as an illustration of the method. Ten grains of the finely powdered marl were introduced with a little water into the vessel A; the instrument was then charged and equipoised. The acid being injected, the whole was allowed to rest for an hour. The weight lost was 2·91 grains. Increasing this in the ratio of 44 to 100, gives 6·61 grains of carbonate of lime in the 10 grains of marl —or almost precisely 66 per cent.

The frequent calls upon me for the analysis of specimens of marl, first led me to the construction of this apparatus, and I have since found it so convenient and accurate, that I can recommend its adoption to such of your readers as may have a taste for chemical inquiries connected with agriculture. Any ordinary worker in glass will construct the

instrument, and skill in manipulating with it may be soon and easily acquired.

Wm. B. Rogers.

[The farmers who are using marl will be greatly indebted to Professor Rogers for the convenient and cheap little apparatus above described—which, judging from his description, not only furnishes the cheapest and most convenient, but likewise the most accurate mode of analysing calcareous manures. It may be easily constructed by any worker in glass—so easily, indeed, that Mr. Rogers made his own by the heat of an Argand lamp, using a few common glass tubes as materials. Every farmer who uses calcareous manures ought to have some means for testing their strength, and this seems to be completely within the power of all to obtain, and to make use of, with very little attention. But, though the process as above described is sufficiently plain to all who have the slightest knowledge of the chemical properties of the substances used, it may appear unintelligible to others; and therefore we hope that the following explanations may be pardoned by those to whom they are altogether useless.

The principle upon which the apparatus works is the same as that of the more expensive and complicated apparatus of Davy, (described in his Agricultural Chemistry,) which we have heretofore considered the best—that is, by separating and ascertaining the weight of the carbonic acid combined with the lime of the manure. Every hundred grains of calcareous earth, or carbonate of lime, is composed always of similar proportions of lime and of carbonic acid—which proportions, by weight, are 56 parts of lime, and 44 of carbonic acid. Of course, if we know how much weight is lost in 100 grains of earth, partly of carbonate of lime, (as marl,) by driving off its carbonic acid, the rule of proportion will show what was the amount of carbonate of lime contained in the sample of earth.

When the muriatic acid reaches the earth in the bulb, it immediately combines with the lime by its greater attraction, and the weaker carbonic acid is disengaged in the form of gas, and escapes into the air through the tube containing the dry muriate of lime —which substance attracts moisture so powerfully as to retain all that might otherwise pass out with the gas. The same muriate of lime will serve for many experiments, as by being heated in the tube its dryness is restored previous to every trial. This salt is formed by the combination of muriatic acid with lime, and therefore every experimenter may provide it for himself by filtering and evaporating the fluid left in this process of decomposing carbonate of lime.—Ed. F. Reg.]

Steamboats on the Western Waters.

In a publication made by the writer of this article in 1829, on the interesting subject of steamboats, it was calculated, that from the time of their first introduction on the western waters in 1811, until that period, their number amounted to about three hundred and twenty-three. Their united tonnage was estimated at fifty-six thousand tons. From the best data which could be procured from the most intelligent sources, the original cost of these boats was five millions six hundred thousand dollars, and the repairs on the same number, assuming that none of them would last longer than 1832, was set down at two millions eight hundred thousand dollars. Now, although there were five or six boats built between the years 1811 and 1817, the latter period may be assumed as the epoch of their regular and successful introduction; in 1825 they were brought to their present state of perfection. It results, then, that the amount expended for the building and repairing of steamboats, in a period of about eleven years, was equal to eight millions four hundred thousand dollars. As the number of steamboats was increasing annually, no fixed amount can easily be assumed for the yearly expenses; but for the year 1829, the sum was fixed at two millions five hundred thousand dollars; if, then, five hundred thousand dollars be considered as a fair yearly average from 1818, the total amount of money expended on the shores of the western waters, up to 1829, inclusive, will be little short of fourteen millions of dollars. When it is considered that this circulation and expenditure of money was exclusively created by the introduction of the steamboat, the importance of this invention to the valley of the Mississippi may be conceived. It has produced an advance of prosperity that would have required more than a century to have realized in the ordinary progress of human affairs; it has produced a revolution in business little inferior in importance to that which followed the discovery of the art of printing.

On the 1st of January, 1824, an official list of steamboats, from an authentic source, gives the whole number of two hundred and thirty, whose aggregate amount of tonnage is equal to about thirty-nine thousand tons. Allowing the cost of building at a rate much lower than the rule adopted three years since, the capital now invested in this stock

will exceed three millions of dollars. The expense of running may be put down nearly as contained in the following scale:

60 boats over 200 tons, 180 running days, at $140 per day, - -	$1,512,000 00
70 boats from 120 tons to 200, 240 running days, $90 per day, - - - - -	512,000 00
100 boats under 120 tons, 270 running days, $60 per day,	1,620,000 00
Total yearly expense,	4,644,000 00

This sum may be reduced to the different items producing it, in the following proportions, viz.:

For wages, 36 per cent., =	$1,671,840 00
Wood, 30 per cent. - -	1,393,200 00
Provisions, 18 per cent. -	835,920 00
Contingencies, 16 per cent.	743,040 00

This result is truly striking to those who were accustomed to the state of things on our rivers within twenty years. The difference in the amount of wages paid is in itself very considerable; but the item of fuel is one created exclusively by steamboats; and when it is considered that nearly one million and a half is expended every year at a few points on the Mississippi valley, it presents a vast field for speculation. The immense forests of beech and other timber, unfit for agricultural purposes, were, before, not only useless, but an obstacle to the rugged farmer, who had to remove them before he could sow and reap. The steamboat, with something like magical influence, has converted them into objects of rapidly increasing value. He no longer looks with despondence on the denseness of the trees, and only regrets that so many have already been given to the flames, or cast on the bosom of the stream before him.

At the present period, the steamboats may be considered as plying as follows, viz.:

25, over 200 tons, between Louisville, New-Orleans, and Cincinnati, meas'g	8484 tons.
7 between Nashville and New-Orleans, - - - - -	2585 do.
4 between Florence and New-Orleans, - - - - -	1617 do.
4 in the St. Louis trade, - -	1002 do.
7 in the cotton trade, - -	2116 do.
57 boats not in established trades, from 120 to 200 tons, - -	8641 do.
The balance under 120 tons in various trades, - - -	14,655 do.
	39,000

In the New-Orleans and Louisville trade, the boats over two hundred tons make about one hundred and forty trips, in prosperous seasons; those of smaller size make from fifty to sixty trips. But to go into an estimate of the number of voyages made by the boats in the different trades is impossible, because no regular data are furnished, and the result depends upon a variety of contingencies.

Previous to the introduction of the steamboat in 1817, about twenty barges, averaging one hundred tons, afforded the only facilities for transporting merchandise from New-Orleans to Louisville and Cincinnati. These making but one trip within the year, gave the means of bringing up only two thousand tons. The present tonnage in this trade exclusively having been stated to be 8484 tons, gives the amount employed, amounting to one hundred and forty trips in the season, to be 1,187,760 tons: a cause capable of producing a revolution in sixteen years hardly equalled in the annals of history. The effects of these causes upon western commerce have necessarily been immense. The moral changes alone are felt throughout the west, and the effect on prices is almost incalculable: the imported article has fallen in a ratio equal to the increased price of western products. In looking back to the old means of transportation, we cannot conceive how the present demand and consumption could have been supplied by them.

To those who are acquainted with the early mercantile history of our country, when it was no uncommon thing for a party of merchants to be detained in Pittsburgh from six weeks to two months by low water and ice, the existing state of things is truly gratifying. The old price of carriage of goods from the Atlantic seaboard to Pittsburgh was long estimated at from five to eight dollars for one hundred pounds. We have instances, in the last five years, of merchandise being delivered at the wharf of Cincinnati, from Philadelphia, by the way of New-Orleans, for one dollar per hundred.

It may not be useless or uninteresting to give an idea of the *mortality* among steamboats in a given time. It is not pretended that any decided inference can be drawn from this statement, or that the facts go to establish any fixed rule. But under the present situation of steamboat discipline and regulations, a tolerably fair conclusion can be drawn from it. Taking the period, then, of two years, from the fall of 1831 till that of 1833, we have a list of boats gone out of service of sixty-six: of these, fifteen were abandoned as unfit for service, seven were lost by ice, fifteen were burned, twenty-four snagged, and five destroyed by

being struck by other boats. Deducting the fifteen boats abandoned as unseaworthy, we have fifty-one lost by accidents peculiar to the trade. In number, this proportion is over twelve per cent. per annum; in tonnage, the loss is upwards of ten per cent. Amount snagged, 3721 tons; amount burned, 2330 tons.

The foregoing calculations and statements afford a great field for speculation. It is evident that there is a vast amount of surplus tonnage, and, of course, the business at present is entirely overdone. Indeed, from a full investigation of the subject, a few years since, by a committee appointed for the purpose, it was fully ascertained, that although the benefits conferred on the valley of the Mississippi were incalculable, the stock invested in boats was, as a general rule, a losing investment—in many cases, a total sacrifice. In a few cases, owing to a fortuitous combination of circumstances, money has been made; but the instances are so few as not to affect the rule. Time may correct this evil; but in a business in which public interest and public safety are so much concerned, a little governmental interference and assistance might be useful, and ought to be tendered. Some legislative action, which might tend to arrest the fearful increase of accident, has long been a desideratum; but how this is to be applied, presents the great difficulty. An experiment, however, has been tried, which seems to hold out the prospect of success. We allude to the company which was formed in 1832–3, called the Ohio and Mississippi Line of Transportation. During the existence of this company, not an accident of any kind occurred to person or property. A perfect regularity in arrivals and departures was introduced, and as all the good boats were in the same interest, there was no foolish rivalship, and consequently no injudicious racing. How far the post-office department would be justifiable in aiding such an association we do not pretend to say, but in our humble view of the case, we consider the great interests of the west are much involved in the question; and when the great uncertainty and irregularities of the mail, which have hitherto distinguished the routes between New-Orleans, Natchez, and St. Louis, and Pittsburg, Louisville, and Cincinnati, are considered, something is expected. On the score of economy alone, the subject is worthy of the reflection of the general government. Probably nine tenths of the correspondence on the western waters is of a commercial character; the greatest portion of this is now transmitted, free of postage, by means of passengers: no one can prevent this. If a line of steamboats can be made interested in protecting the government, the general post-office would find it to its advantage to give liberal terms to such an establishment. N.

[Western Magazine.]

Manufacturing Establishments at Cincinnati, Ohio, in 1834.

There are more "manufacturing establishments" in this city than in any city or town in the west. Pittsburgh ranks next to us in that respect, and perhaps is ahead of us, when we take into consideration the difference of population. Cincinnati has a third more inhabitants than Pittsburgh. We have twelve or thirteen foundries and engine factories, for the manufacturing of engines for steamboats, flour mills, grist mills, rolling mills, and for blast furnaces, used in this section of country, and for sugar mills, corn mills, cotton gins, saw mills, and other uses, for the south, where an immense amount is exported yearly. An estimate was made in 1832, for the year previous, of the amount exported of articles of the above description, and it exceeded $400,000.

We have also a large and extensive rolling mill, owned and conducted by Messrs. Shreve, Paull, and M'Candless, gentlemen of great enterprise, who employ about one hundred men; they cut some ten to eleven tons of nails per week. An extensive and complete spade and shovel factory; seven or eight bell and brass foundries, where an almost unlimited amount of work is done; twelve steam saw mills, all of which are conducted on a very large scale—at most of them there are machines connected for cutting laths, shingles, &c.—5 to 7000 laths can be cut in an hour. At some of these mills they have a saw for cutting boards and timber, a circular saw, and a machine for planing flooring boards, all driven by steam power.

Two flour mills, one owned by C. Bradbury, Esq., and driven by water from the canal—they make sixty or seventy barrels every twenty-four hours. Connected with this establishment is an oil mill, for the manufacturing of linseed and castor oils; there is also a mill connected for grinding and sifting corn meal, large quantities of which are barrelled and exported. Our largest and most extensive flour mills in this section of the state are on the Big and Little Miami rivers, which empty into the Ohio above and below this city, and are situated from ten to fifty miles from Cincinnati; they manufacture, some one hundred, some one hundred and fifty, and some two hundred barrels,

every twenty-four hours. All this flour is sent to this market by canal and waggons, and then exported to New-Orleans, the Atlantic cities, &c. The other flour mill in the city is worked by steam, and can manufacture, when in operation, one hundred and fifty barrels per twenty-four hours. I would stop here to remark, that there are about sixty steam engines in constant operation within the corporation lines, exclusive of those on our steamboats, and *all* high pressure; low pressure engines are not in good repute in the west.

A card manufactory, owned by M. P. Cassilly, Esq. where every description of machine cards are made. A large number of establishments for the manufacture of steam boilers, where hundreds of men are constantly employed. A stereotype foundry, and also a large and extensive type foundry, owned by N. Guilford, Esq. and others, where is manufactured every variety of type, printing presses, and every article connected with the printing business; there are eleven or twelve machines for casting type, and sixty to seventy hands are constantly employed; they manufacture to the amount of some 50 to $60,000 per year.

A steam fire engine factory, owned and conducted by Messrs. Chase and Seymour. The engines manufactured by them are equal for power, beauty, and workmanship, to any manufactured east of the mountains.

A patent lever lock factory, by Messrs. Shawk and Fitz.

A steel saw and file factory, by Messrs. Garrard & Co.

A printing press manufactory, on an extensive scale, by S. Dickinson.

A saddle tree manufactory, machinery driven by steam, conducted by Messrs. Kendall & Co.

A clock factory, by Lerman Watson, Esq. where are manufactured clocks, both of brass and wood. The establishment is a large one; many hands are employed, and many clocks made, of every description.

A factory for rolling sheet lead, and drawing lead pipes, by steam, for hydraulic purposes.

A steam stone saw mill. This establishment is worked on a new principle, and is patented to the proprietor, (Mr. Jas. Henderson.) It cuts stone with great accuracy.

A white lead manufactory, by steam power, owned by James M'Candless, Esq.

A bark and leather rolling mill, owned by the Messrs. Clarks, and worked by steam. The manufacture of malt liquors is carried on very extensively in the city, and to great perfection. There are eight very large breweries, and the beer, porter, and ale, manufactured by them, is equal to any I have ever seen in the eastern cities. We have a great number of snuff and tobacco manufactories, last factories, candle and soap factories, &c. Hats, furniture, &c. are manufactured in great quantities, and exported for sale to Kentucky, Tennessee, Mississippi, Louisiana, and every State south and west of us.

My limited information on the subject of manufactories, as well as want of time, will prevent me from giving you a more minute account of the manufacturing and mechanical business carried on to a very great extent, and to equally great perfection, in Cincinnati. I have named a few, and only a few, of the largest establishments, those that have come to my mind while writing; there are many others, where great numbers of hands are employed, that I do not at this moment think of. Opposite the city, at Newport, is a large cotton bagging factory. It is on a very extensive scale, owned by an incorporated company, with a capital of half a million. They manufacture bagging, bale rope, twine and cordage, Kentucky jeans, cotton and woollen coarse goods, sheet lead, and pipe—all of which is carried on by steam power. The machinery, when in full operation, will use annually 450 tons of hemp, 850 bales of cotton, 95 tons of wool, and 200 tons of lead. The agent resides and transacts all the business of this establishment in Cincinnati. There is also, in Newport, a steam saw mill.

In Covington, also opposite to this city, is a large cotton factory, owned by C. Macallister & Co. of this city; they run 2500 spindles, and manufacture 300,000 lbs. cotton yarn per annum. Sixty hands are employed. The yarn is sold here. There is also in Covington a rolling mill on a large scale, a rope walk, steam flour mill, and a steam saw mill.—[Patriot.]

MANUFACTORIES IN PITTSBURGH.—The various manufacturing establishments of Pittsburgh are thus briefly enumerated in a late number of the Gazette of that city.

There are, says that paper, in the city of Pittsburgh, 16 "foundries and engine factories" of the largest denomination, besides numerous other establishments of less magnitude.

There are 9 "rolling mills," cutting two tons of nails and rolling eight tons of iron per day, on the average, and employing from seventy to ninety hands each.

There are 6 "cotton factories", with an aggregate of twenty thousand spindles, one

hundred and sixteen power looms, and one hundred and seventy hands.

Six extensive "white lead factories."

Five extensive "breweries," besides small ones.

Six "steam saw mills."

Four "steam grist mills."

Ten extensive "glass works."

Upwards of one hundred "steam engines in full operation."

There are, moreover, innumerable establishments for the manufacture of ploughs, timber, wheels, screws of all kinds, saddle trees, machine cards, bells, brass work of every description, locks, &c. &c. all manufactured extensively for exportation.

Silver Mines of Barnaoule.—These are located on the confines of China, near the boundary between China and that country. There are thirty-two mines, wrought by eighty-two thousand persons, divided into three parties, so that the operations are never suspended night or day. The wages are very trifling. The whole of the silver is transported to St. Petersburg, for coining, and other purposes of the government.—[Scientific Tracts.]

A Sister's Love.—There is no purer feeling kindled upon the altar of human affection than a sister's pure uncontaminated love for her brother. It is unlike all other affections, so disconnected with selfish sensuality, so feminine in its developement, so dignified, and yet withal so fond, so devoted.

Nothing can alter it, nothing can suppress it. The world may revolve, and its revolutions effect changes in the fortunes, in the character, and in the disposition of her brother; yet, if he wants, whose hand will so readily swell his advocacy?

Next to a mother's unquenchable love, a sister's is pre-eminent. It rests so exclusively on the tie of consanguinity for its sustenance—it is wholly divested of passion, and springs from such a deep recess in the human bosom, that when a sister once deeply and fondly regards her brother, that affection is blent with her existence. In all the annals of crime, it is considered something anomalous to find the hand of a sister raised in anger against her brother. In all the affection of woman, there is a devotedness and strength which cannot be properly appreciated by man. In those regards where the passions are not at all accessary in increasing the strength of the affections, more sincere truth and pure feeling may be expected than in such as are dependent upon each other for their duration, as well as their felicities.

A sister's love in this respect is peculiarly remarkable. There is no selfish gratification in its outpourings; it lives from the natural impulse; and personal charms are not in the slightest degree necessary to its birth and duration.

The Christian Library—a weekly re-publication of the most popular religious works, under the superintendance of the Rev. Jonathan Going, Rev. John F. Schroeder, and Rev. John M. Krebs. Quarto, Nos. 1 to 19. Thos. George, Jr., 162 Nassau street, New-York.

Amidst the numerous cheap periodicals that are daily issuing from the press, we know of none more valuable, none more calculated to serve the best interests of society, than the one now under our notice. It places within the reach of our fellow citizens, for *three dollars* per annum, as much as could be obtained in the ordinary way for thirty or forty dollars, consisting of memoirs of most of the distinguished divines, such as Owen, Baxter, Doddridge, Martyn, Hall, &c., historical narratives of the progress of religion and civilization in all parts of the known world, and re-prints of the most valuable and popular productions of such eminent men as Leighton, Bickersteth, Bunyan, Edwards, &c. &c. Such a publication cannot fail to be an interesting and valuable appendage to every library, and may with confidence and pleasure be placed in the hands of the rising generation by every parent and guardian. We most cordially recommend it for its utility and economy, and, we may add, for the very superior manner in which the publisher issues it to his subscribers. The three first numbers contain the whole of the memoirs of Rev. H. Martyn; 4th, 5th, 6th, the whole of that admirable work by the late Hannah More, entitled "Practical Piety"; 11th, 12th, and 13th, the whole of Dr. Dick's Christian Philosopher; and the latter numbers contain the memoir of that distinguished and venerable, although eccentric individual, *Rowland Hill*, by his relative, the Rev. Edwin Sidney, together with other works of sterling merit.

The *Mechanics' Magazine and Register of Inventions and Improvements* is published by the Proprietors, D. K. Minor and J. E. Challis, at No. 35 Wall street, New-York: in *weekly* sheets of 16 pages, at 6¼ cents—in monthly parts of 64 pages, at 25 cents—in volumes of 384 pages, in cloth boards, at $1.75—or at $3 per annum, *in advance*.—John Knight, (formerly proprietor of the London Mechanics' Magazine,) Editor.

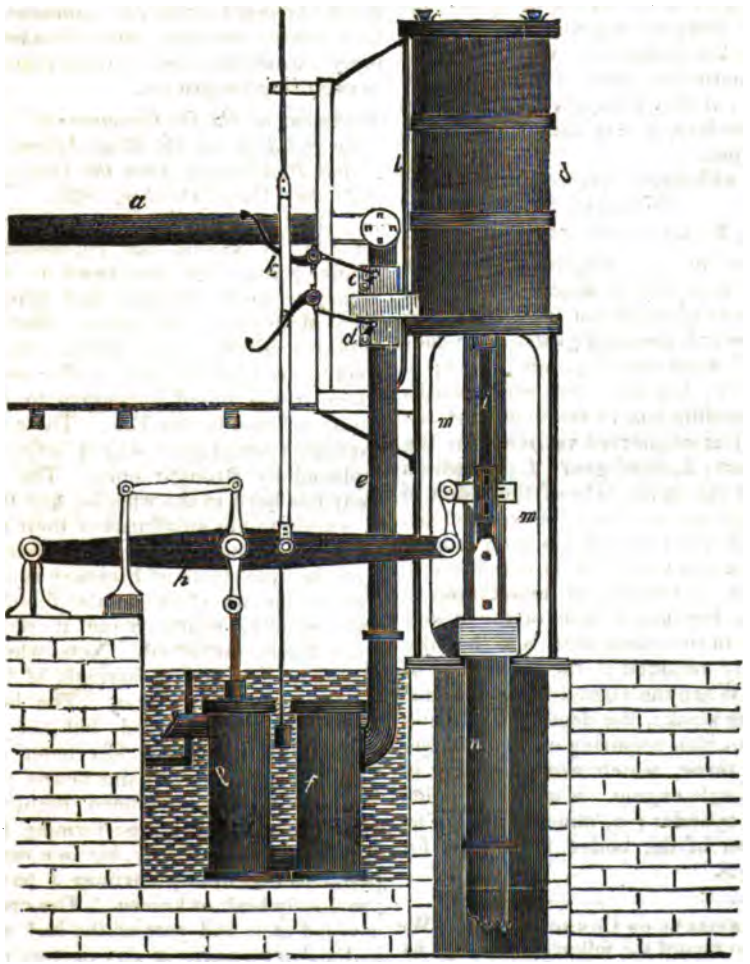
MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

VOLUME IV.] FOR THE WEEK ENDING DECEMBER 20, 1834. [NUMBER 6.

SYMINGTON'S LIFTING STEAM ENGINE.



[From the London Mechanics' Magazine.]

SIR,—I send for your inspection the accompanying drawing and description of my father's improved lifting steam engine, patented in 1801: an engine which admirably fulfilled the purpose of its inventor, and possessed many advantages over those even at present generally employed.

With what ease its principle can be rendered effective for the propulsion of vessels, an examination of the plate annexed to Mr. Bowie's pamphlet will render evident.

It may not be out of place here to remark, that the getting rid of the beam, a heavy, cumbersome, and unwieldy appendage, has been considered desirable. Such a desideratum this engine presents, the only thing connected with it at all approximating to a

beam, being the lever employed for working the air pump.

Several of these engines were constructed by my father, and I am credibly informed that one on the same principle, as far as regards the mode of communicating the power of the engine, without the intervention of a beam, has been erected at Broken Wharf, a place to which the water-works were removed prior to the taking down of old London bridge, the engineer having obtained information respecting the engine, and also a drawing, from a gentleman not altogether ignorant of its component parts.

If any acknowledgment was made to whom the merit was due of effecting the improvement, of which the parties concerned availed themselves, it has hitherto escaped my observation.

I am, sir, with much respect, your obedient servant, WILLIAM SYMINGTON.

1, Mary street, Bromley, Oct. 15, 1833.

Description of the Engraving.—*a*, the steam pipe; *b*, cylinder, which is closed at top; *c*, valve to admit steam from the boiler to the cylinder; *d*, discharge valve; *e*, eduction pipe; *f*, condenser; *g*, air pump; *h*, air pump lever; *i*, piston rod, which works through a stuffing-box in the bottom of the cylinder, and is connected vertically to the mine pump-rod; *k*, hand-gear; *l*, pipe which conveys from the upper side of the piston to the condenser any escape of steam or air, which may at times take place from imperfection of the packing. It is necessary to observe, that a vacuum is maintained at all times on the upper side of the piston equal to that in the condenser, and that the steam is only admitted to the under side of the piston. When the engine has performed the ascending stroke, the descending one is made in vacuo, thus requiring only two valves in place of three, which are necessary in Mr. Watt's single engine. *m m*, frame which supports the cylinder; *n*, mine pump. The representation of the boiler is omitted for want of space.

STEAM CARRIAGES ON COMMON ROADS.—We are pleased to record the following, having, as we do, great faith in the successful application of steam to road carriages.

The New-Bedford Gazette states, that a project is on foot for the construction of a road from that town, through Taunton, to Boston, for the purpose of being used for steam carriages; and a series of letters from Robert Mills, Esq., the projector, is commenced in that paper on the subject. The advantages of this description of locomotive travel, over that upon a railroad, are urged with great earnestness and considerable plausibility.

Mr. W. Hancock's Steam Carriages.

[From the London Mechanics' Magazine.]

Annexed is an engraving* of Mr. Hancock's new steam carriage, the Era, which has been plying for these several weeks past along with our old acquaintance the Autopsy, between the city and Paddington. It is by far the best which Mr. Hancock has yet constructed; extremely compact, elegant, and efficient. We subjoin an authentic, and at the same time very candid and honest, statement of the performances of both of these carriages since the commencement of their present running, which has been obligingly furnished to us by their ingenious and persevering proprietor.

Statement of the Performances of the Autopsy and Era, on the Road between London and Paddington, from the 18th of August to the 11th of October, 1834.

The Autopsy commenced running on the 18th of August, and continued about a month, going each day twice to and from Moorgate to Paddington, and twice to and from Moorgate to Islington. Nothing particular occurred to the machinery save the shaking out of the key of the side valve, when it was found necessary to draw the Autopsy home by the Era. The eyes of the carriage springs gave way a little, but were replaced by stronger ones. The principal wear has been in the wheels; and this chiefly owing to the smallness of their diameter, when encountering the deep holes in the wretched pavement of Finsbury square. The tires of the wheels were also found to elongate rapidly, which made it requisite to have them contracted. New wheels have just been put on this carriage, of larger diameter and thicker tires. The boiler has been carefully examined, but not the least perceptible difference has been detected. The fireplace, too, remains nearly the same.

The Era has now been running rather more than a month, performing the same distance as the Autopsy, but in a manner superior to that of any carriage I have either previously built or known. The crank shaft severed at a bad part of the bad pavement in Finsbury square a day or two after she commenced running, but this was replaced, and the carriage started the next morning at the usual hour, and has ever since continued at work, with the omission of only one journey, arising from the extension of an unsound place in the casting of the wheel flange.

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* The engraving here referred to is omitted. The Autopsy, which is very similar, may be found in Vol. 2, page 137, of this Magazine.

I find on this hard road the wheels are severely tried; but this road, hard as it is, has been of inestimable value to me in regard to experience, pointing out with unerring certainty where more strength is wanting. The Stratford road, for instance, would have completely deceived me with regard to wear and tear of wheels. I should estimate the tear and wear on the former at double that of the latter; but then it should be borne in mind, the Macadamised part from King's to Tottenham court road is in a very bad state. I would advise all parties interested to keep this fact in view. They must bring their vehicles to a similar test before they can conclude experiments having for their object the means of arriving at a just estimate. On level and smooth roads a great display may be made, but such trials are fallacious and deceptive.

I forget to mention that some times, when I have had to take up a passenger on a bad piece of pavement, if the propelling wheels chanced to stop in a hole, the friction on the (perhaps only two) stones has not been sufficient to start the carriage, but by reversing the motion of the slide valves, and backing a few feet, (just as you would with horses,) the carriage is at once propelled forwards. But we may surely hope that some day or other the great public thoroughfares will not be suffered to remain in holes.

The consumption of coke has hitherto been from 8 to 12 lbs. a mile, and about 100 lbs. of water for the same distance.

We have up to this time carried nearly 4000 passengers in perfect safety, and I am happy to say, that the Jehus of the road get more friendly and reconciled to us; and as it is my intention to employ steady coach drivers as steersmen, the sooner this feeling is fully developed the better. Why should there be the least ill-will? What difference can it make, whether they drive horses, or

"Sweep o'er the hills in the glory of steam?"

I intend next week to advance another step, and to go one journey more each day. I have been blamed for not doing this sooner, but others may do as they please. I am content to move slowly, so that I continue to move well, although it may be at the expense of a little "ignorant impatience" on one side, or the want of "absolute wisdom" on the other. W. Hancock.

We add a description of the progress Mr. H. has made, and the difficulties he has had to encounter, from an intelligent correspondent of the Repertory of Patent Inventions.—[Ed.]

To the Editor, &c.*

Sir,—Any unprejudiced person, particularly if a lover of science, and having any regard for the welfare of his country, can but view with satisfaction and pleasure the performance of Mr. Walter Hancock's steam carriages, now running between London and Paddington; and no doubt Mr. H. must feel highly gratified at having, after a toil of *eight years*, brought to perfection and public approval these self-acting machines.

If the subject was one of mere show, or idle speculation, instead of actual national benefit, we could but admire his zeal for the completion of his object, and his determined spirit, amidst all the oppositions and difficulties thrown in his way to embarrass his laudable career.

The pretenders to science have, on paper, written that to be impossible which the head and the hands of Walter Hancock have given denial to, in a less perishable form.

Following the great Bacon of old, he has preferred actual experiment to doubtful theory, and thus progressing has accomplished his work. I have watched his *labors year by year*, and know that any reward which may now await him cannot be too great for them.

At the first proposal of steam locomotion on common roads, the tone of the public mind did not harmonize with it; indeed, to the present moment there are men, with the knowledge that carriages are actually running, who affect to doubt even its practicability; and what may appear equally strange, is the fact that eminent engineers, who formerly entertained similar opinions, are now actually (if I may borrow the phrase) *compiling* a carriage from the experimental materials furnished by the labor and at the cost of those they would have had the world despise. They have escaped the insults and the scoff and ridicule of their leaders, and are now for sliding in to share their merits and emoluments.†

The greatest and the most dreaded obstacle was that of ascending hills. Calculations upon traction have been made, and devices have been planned, by mechanics, to overcome this visionary impediment; but they may now regret the loss of their la-

* We have great pleasure in giving insertion to this communication. Making some allowance for the enthusiastic feeling expressed, we agree with the writer, that Mr. Hancock deserves great credit for his perseverance and talent, and we heartily wish him success.—Ed.

† "This circumstance is not fairly stated," says the editor of the Repertory of Patent Inventions, and he adds his explanation of the affair, exculpating several scientific men from the charge of borrowing Mr. Hancock's plans, which would not at all interest our readers.—Ed. M M.

bors, as by the power contained within the carriages themselves, (and not by additional, costly, and cumbersome mechanical appendages,) they may daily see the "Infant," the "Autopsy," or the "Era," loaded with passengers, ascending the badly kept road of Pentonville hill.

It is worthy of remark, that the beautiful and commodious carriage, the "Era," was not expected to ascend that hill at a greater speed than six miles, but it generally performs at the rate of eight miles in its worst, and ten miles in its better parts, whilst on the level road it will maintain 16 miles per hour.

As a proof of its power, a few days back a small pin dropped out of some of the machinery of the "Autopsy," by which it was brought to a stand; the "Era" was fetched out, and with great ease towed the "Autopsy" (whose weight is supposed to be three and a half tons) to the station in the City Road, performing up Pentonville hill at the rate of five miles per hour.

Mr. Hancock commenced his experiments in the year 1826, by constructing the carriage now called the "Infant," but the form and arrangement of the machinery of it were then very different to what they now are. Mr. H. frequently run it out in the neighborhood of his factory, at Stratford, and, on each return, minutely examined its works, and discovering their defects, either altered and improved those already in use, or invented and substituted parts to replace them.

In constructing his boiler, he first tried various combinations of tubes, a mode which in theory appeared to possess advantages, and had been the favorite one of several engineers, yet in practice: being dissatisfied with every modification of tubes, he gave them up. Having, however, by this practice, discovered the *requisites* of a boiler adapted for steam locomotion, he set his inventive mind to work, and the result was his present boiler, which consists of a series of thin parallel chambers, placed vertically, with narrow spaces between each chamber for the play of the fire: the chambers are, by a singular and very effective contrivance, all connected with each other near the top and bottom, and are prevented distending by a number of vertical bars placed up between them, or by projecting hemispheres in the side of each chamber, and the whole tied together by immensely strong bolts and braces.

After securing his invention by a patent, and now possessing the grand stamina of a steam carriage, namely, a boiler which is cheap in its construction, of little weight, not subject to leakage, an economist of fuel, and which generates dry steam very rapidly, he continued his experimental trips with greater confidence and increased expectations of ultimate success; and by the year 1831, after having spent five years of the prime of life in unwearied application, and most likely expended as many thousand pounds, not one farthing of which had been supplied from any public source, he found himself in a situation to offer his invention to his country; this was to him a most unpleasant task, for throughout his experimental career, with the exception of his private circle of friends, no individual was ever less supported; he was sneered at by the pretenders to science, derided by the press, and pitied by the benevolent as a mechanical enthusiast,—these were his fireside comforts; when out, insulted,—and in his way impeded by coach masters, or their men, by horse dealers, corn dealers, and all who conceived their interests in jeopardy, although at the same time they all declared steam coaches never could be brought into use. This appears somewhat paradoxical, but the perversion in the minds of some men cannot be accounted for.

The first company formed to run his coaches was the Brighton; for this company he built the "Era," (not the one now running to Paddington:) with the exception of a few trial trips, twice to Windsor, &c. it has never worked, I believe, and *is* now waiting the determination of the proprietors.

In the year 1832 the Paddington company was formed, and a carriage to be called the "Demonstration," afterwards altered to the "Enterprise," was finished, and run the London and Paddington road for sixteen successive days, on hire, in the months of April and May, 1833. Mr. Hancock having performed this part of his contract with the company, delivered the carriage to them, and was for proceeding, without further delay, to execute the two others, according to agreement; instead of which the "Enterprise" has now been kept shut up 16 months. During all this time, an engineer, who has his friends amongst the company, has been building one on the same premises where the "Enterprise" stands, and which has for all this long period filled the honorable post of dumb instructor.

The treatment which Mr. Hancock had now received, after seven years' exertions, would have induced many men to abandon their object altogether as an unlucky one; but not so with him: instead of following and submitting to the caprices and treatment of this company, he determined to build for

himself, and has now two carriages of his own, running on his own account, on the same road.

Like the gardener in the fable, he did not stop to repine at his loss; but without delay, and with increased energy, set to work again. Since the "Enterprise," he has built the "Autopsy," refitted the "Infant," built the new "Era," and has nearly completed another carriage not yet named, and has built a steam-drag for Mr. Voigtlander, of Vienna, which was shipped last July.

The "Infant" was the first steam carriage that passed through the city by steam, or that ever was at Brighton; it ran there, from Stratford, twice during the autumn of 1832.

The "Autopsy" also steamed through the city in the middle of the day, on its return from Brighton, on the 10th of October, 1833.

In November, 1833, the "Autopsy" ran for three weeks, on hire, between Finsbury square and Pentonville; but as it divided Mr. Hancock's attention from his carriages then in progress at Stratford, he withdrew it.

Since then, Mr. H. has fitted up a station on the City Road, and made the necessary arrangements for a supply of water; and from here his carriages first commenced their now regular run from the city to Paddington and back, on Monday morning, the 18th of August last, and have now been running daily more than two months, and conveyed upwards of 4000 passengers at the usual omnibus fare of sixpence each. Steam carriages have some claim upon the attention of the political economist, especially when it can be proved that they will afford an accession of manual labor far above that of the present system.

The only drawbackupon manual labor, in a general view, would be in the repairs of roads, for as steam carriages run with a wide flat tire, they will consolidate and improve a road, whilst the narrow tires of our present coaches, but, above all, the ploughing up and battering by the horses' feet, quickly deteriorate it.

The accidents and loss of life so frequently occurring, by the horses of stage coaches becoming unmanageable, will be avoided by the adoption of steam carriages, for it is impossible for any thing to be under a more perfect control; they are to be steered with the greatest ease and precision, and stopped or started instantaneously at pleasure.

During Mr. Hancock's experimental progress, nothing annoyed him more than the magnitude and consequence attached to any trifling failure, and which is generally allowed to be incident to any new mechanical invention. It has either been from enmity to, or jealousy of, a clever, persevering or plain-dealing, single-handed man; or those who have made so much of these matters have acted in ignorance or forgetfulness, that the present stage coaches in this country, the race of horses by which they are drawn, with their harness, and equipments, have been the work of ages—have engaged the attention of thousands of heads—at the cost of hundreds of thousands of pounds.

Does any one doubt what travelling probably once was in this country, let him travel others, let him visit almost the whole continent of civilized Europe, and I wish him safe back to England, however jolted and shaken, to hail it with pleasure and gratitude, as the hot-bed of genius and invention.

At the present day, it is not an unusual circumstance for a stage coach to have a trace broken or a splinter bar fail, but let an infant steam carriage stop upon the road, although its damage is no greater, and repaired in equal time, it would be published as a complete failure.

Should any theories of strength, and stress, and proportions, &c. of steam carriages be published hereafter, let it be remembered that they have followed, not preceded, the practice.

There are many difficulties attendant upon land steam locomotion, compared with fixed steam machinery or marine steam locomotion; for in many parts of these, either weight or bulk is of little more consequence than cost of material; if a boiler is not powerful enough, make another plentifully capacious; if a frame or a shaft is to be constructed, never mind how strong it is made, so that it is strong enough; but in a road steam carriage, the great puzzle has been to get a powerful boiler in a small compass and of little weight, to have all parts of the machinery and framing strong enough, not too strong; in fact, it is that every ounce is an encumbrance and a dead weight upon the wheels, and requires its ounce worth of power to move it; to perform this, larger and consequently heavier machinery is required, which again adds weight upon the wheels, and a consequent enlargement of power is again required.

Giving this due attention, it will be seen, that by no ordinary arrangement, or such as is applied to any present fixed machinery or marine locomotion, can a steam carriage work with any effect; in the first, neither space nor weight are of consequence; in the second, space may be considered more

than weight, but in a steam carriage space is very limited, and weight is of every consequence, because it is all dead upon its own resources; in fact, a road steam carriage, on a level, but particularly up hill, is a perfect self-acting machine; a steam vessel is not so, because the path of its progress is in itself buoyant.

In conclusion, I hope that when the "Infant" has run its course,—and, long as it may be, that day will come,—it will not be broken up; but then, when, I doubt not, steam locomotion will have become general, and all prejudices subsided, the "Infant" may be preserved in one of our national repositories of art.

Apologizing for the length of my letter, I remain, sir, your obedient servant,

A Retired Tradesman.

London, October, 1834.

[From the American Railroad Journal.]

We have great pleasure in publishing the following letter and facts, furnished us by an esteemed friend now abroad.

London, Sept. 23, 1834.

To the Editor of the Railroad Journal, &c.

Sir,—Having occasion, a few days since, to accompany two Philadelphia gentlemen to call on Mr. Hancock, who has steam carriages travelling on the common roads of this metropolis, I beg to give you some memoranda of the information I obtained from the conversation with that gentleman, which may probably interest the numerous readers of the excellent and most useful "American Railroad Journal," which I receive regularly from my brother in Philadelphia, and always peruse with the greatest pleasure.

Enclosed I send you the principal information derived from Mr. Hancock.

Before I left home (Philadelphia) last spring, I had frequently endeavored to gain information respecting the expediency (the practicability has been established beyond doubt by the engines of Gurney, Ogle, Hancock, Maceroni, &c.,) of steam carriages on turnpike roads, and pavements, but could not obtain any facts to satisfy me that they could be used in competition with coaches drawn by horses. Since my arrival in London, the information given induces me to believe they *may*, under favorable circumstances, *in this country*, compete with animal power, but I strongly doubt whether they will answer equally well in our country; and I think it highly probable that, in the course of a short time, they will be much more generally used in England for stage coaches, and for the transportation of the mail. This opinion is founded on the following circumstances: 1st, horses are costly in England, and are maintained at great expense; 2d, the roads are good, and kept in perfect order; 3d, steam power is cheap, owing to the low price of all machines made of metals, as well as the low price of fuel. In our country, on the contrary, horses are cheap, and are supported at one half the cost that is customary in England; 2d, our roads are unfortunately constructed on wrong principles,* and are consequently excessively bad, and will remain so until they are made on a better plan; 3d, fuel and labor are expensive in our country. From the above mentioned circumstances, I think there is some probability of their becoming useful machines in this country, but I cannot suppose they will be profitably employed in the United States. There are, however, some roads and streets on which they *might* be used—for example, between Boston and Salem; between Providence and Pawtucket; from the Battery to the highest part of Broadway in your city; and from the Exchange to the Schuylkill river, in my city; and there may be some other locations, which, however, it is unnecessary to mention, where the roads may be sufficiently good to enable the locomotives to travel on them; but it is out of the question to expect them to travel over turnpikes equally bad as those of my native state, which, although not so bad as in some of the other states, are so rough as to be discreditable to our citizens.

I have written you a few hasty lines, which, however, are at your service, if you wish to make use of them; and if I can do any thing to be useful to your publication whilst in this country, I shall be much pleased to aid in any way you may point out. My address is, care of Timothy Wiggin, Esq., London, or care of A. & G. Ralston, No. 8 South Front street, Philadelphia, by which channels every thing will be carefully forwarded to me. I am, very respectfully, your obedient servant,

Gerard Ralston.

Liverpool, Oct. 24, 1834.

Postscript.—By some oversight, I find that I did not send this communication to you at the time I ought to have done so. Since the date of my preceding letter, I have made several journeys in the "Autopsy" and "Era," and have not seen nor heard any thing to alter my views as expressed above. It is, however, proper to mention to you that, from my occupation in this country, namely, to

* To prevent misconception, it may be proper to mention in what respects our turnpikes are defective. 1st, They are too *convex*; they rise too much from the sides to the centre, and the consequence is that all the travel is forced on to the crown of the road, which is soon worked into *four ruts*, two of which are formed by the two horses' feet, the other two by the wheels of the carriages; but if the roads were nearly flat, as they are in England, the travel would be equal over the whole surface, and then every part of the road would be equally good. The 2d defect is the *metal* is not homogeneous, (hard and soft stone ought never to be used together,) and not broken sufficiently small. The 3d defect is the absence of sufficient under-draining. On our turnpikes, and indeed even in our streets, I have seen *uncovered drains* across the roads, which of course cause an inequality of the surface, and injure the carriage and horses, and interfere with the comfort of the persons in the carriage. I hope most sincerely my countrymen will "mend their ways"—they are truly abominable; and it would not be more expensive to make roads equally good as those in Great Britain and Sweden, than to make them in their present bad condition.

furnish railway iron, locomotives, &c. &c., for various railroads in the United States, I am frequently brought into company with some of the most eminent engineers of this country, of all of whom I have inquired their opinions respecting the expediency of locomotives on turnpikes—they have invariably replied, "They will not be profitable." They say, "You can see them running on the roads—they go beautifully, and you suppose prosperously, but they work to a disadvantage of 10 to 1 compared with locomotives on railways, and it is impossible for them to supersede horses on turnpikes or locomotives on railways."

Mr. Hancock, who is undoubtedly a man of genius, and is, withal, very quiet and unpretending, appears quite confident that he has succeeded, and that he is now making money. In a few months more, it is probable, if he continues to run, that he will be able to divulge to the public something of an official character, that will satisfy all doubters either of the expediency or inexpediency of this mode of locomotion. The question is no longer one of practicability, but of profit. It is proved to be practicable; but will it be profitable, is the important question. I shall return to London in a few days, and should I hear any thing of importance on this subject, I will have the pleasure to communicate it to you. In the mean time, yours, respectfully, G. Ralston.

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Facts relative to the Use of Steam Carriages on Common Roads, furnished by Mr. G. Ralston.

Called on Mr. Hancock, who gave me information respecting the "Era" and "Autopsy," constructed by him, as follows.

The cost is £700 each. They each have 2 steam engines, of about 10 to 12 horse power, high pressure, and accommodate 14 passengers each. Coke is the fuel used; ½ bushel per mile is consumed, and 100 lbs. of water per mile. The capacity of the boiler is 700 lbs. of water, which would be sufficient for a distance of 7 miles. The weight of the omnibus complete is 3 tons, exclusive of fuel and water. The road and pavement, (from the neighborhood of the Bank of England to Paddington,) over which these carriages travel, is the worst in the neighborhood of London; indeed, I think it the worst road I ever saw in England. The distance is 3 miles on the most frequented thoroughfare in the world, and it is astonishing how perfectly controlable it is, how easily it is guided, how easily stopped—indeed, it is much more controlable than a two-horse omnibus. It goes at the rate of 10 to 12 miles per hour, which, for the present, is considered the most economical speed. The Pentonville hill, which these carriages ascend, has a rise of 1 in 20, but the Autopsy has gone over hills on the Brighton road of 1 in 10 feet. There is a hill between London and Brighton of 1¾ mile long, which this carriage ascended at the rate of 9 miles per hour, at the commencement of the rise, and gradually diminished its speed to 6 miles per hour. The "Era" performed the following wonderful feat a few days ago: She dragged the "Autopsy" over the bad road to Paddington, up the Pentonville hill to the station, both carriages being full of passengers. The weight of the two, with their loads, is estimated at near 8 tons.

Animal Power.—Dupin states, that the animal power in Great Britain is eleven times as great as the manual power, while in France it is only four times as great.

The following is the number of horses for every 1000 inhabitants in the countries mentioned. Hanover, 198; Sweden, 145; Canton de Vaud, in Switzerland, 140; Great Britain, 100; Prussia, six Provinces, 95; France, 79.—[Quar. Jour. of Agr.]

Feather Beds.—The want of feathers is altogether artificial, arising from a disregard of the physical and moral well-being of infants and children; and he who has the good fortune never to have been accustomed to a feather bed, will never in health need or desire one, nor in sickness, except in cases of great morbid irritation, or excessive sensibility, or some disease in which the pressure of a firm or elastic substance might occasion pain. But when a rational regard to the preservation of health shall pervade the community, feathers will no more be used without necessity, or medical advice, than ardent spirits will be swallowed without the same necessity or advice. The physician has frequent occasion to see persons who are heated, sweated, and enfeebled, by sleeping on feathers, as if from a fit of sickness, enervated, dispirited, relaxed, and miserable.—[Med. Intel.]

Cure for Weak Eyes.—Take a small lump of white copperas, say about the size of a pea; put it in a small phial, holding about two ounces of water: carry this in the pocket, and occasionally taking out the cork, turn the phial upon the finger's end, and thus bathe the eyes. This will positively effect a real cure in a short time.

Cure for the Sting of a Wasp.—A few days ago, happening to be in the country, we witnessed the efficacy of the remedy for the sting of a wasp, mentioned in one of our late papers. A little boy was stung severely, and was in great torture, until an onion was applied to the part affected, when the cure was instantaneous. This important and simple remedy cannot be too generally known, and we pledge ourselves to the fact before stated.—[Liverpool Mercury.]

Potato Starch.—Let the potato be taken and grated down to a pulp, and the pulp placed upon a fine sieve, and water made to pass through it; the water will be found to have carried off with it an infinite number of particles, which it will afterwards deposit in the form of white powder, separable by decantation, which powder is starch, possessing all the essential properties of wheaten starch.—[Loudon.]

Employment of Time.—A person takes up some useful or agreeable book every morning at breakfast, and at the end of the year has spent agreeably, and we may say profitably, as many half hours as will come to nearly three weeks; another always takes up a Latin grammar, and a Janua Linguorum, in the same intervals, and at the end of the year has acquired a tolerable knowledge of Latin. Thus, you see, that whether a young man shall know two or three languages besides his mother tongue, and something of natural history and philosophy, may depend on the seeming trifling circumstance of how he spends the few spare minutes at the beginning and ending of his meals, from the age of fifteen to twenty-five.

Zincography.—It was but a few years past that we had to record an advance in the fine arts in the invention of lithography, which afforded increased facilities in the art of engraving. Lithography is now, however, likely to be displaced, at any rate to a great degree, by the invention of an ingenious Frenchman. M. Breugnot, who has succeeded in preparing a composition of metal, the basis of which is zinc, upon which drawing and writing can be effected with equal, if not with greater facility, than upon stone, and as easily applied to paper with the same machinery. The art of zincography has several advantages over that of lithography; among others, in the portability and comparative cheapness of the plates, over the necessary bulkiness and cost of stone. These plates can even be adapted to a lady's portfolio, to any thickness, and to any size—a desideratum much wanted in lithography. The invention of zincography has received the sanction of the Royal Academy of Paris, and we understand that M. Breugnot has sold the patent for Great Britain to Mr. Chapman, of Cornhill, who feels confident that he shall be able to adapt this improvement to every department in the art of engraving. In Paris they have already succeeded in printing large window blinds with one plate, and we believe experiments have been made on silk and cotton, which warrant the supposition that zincography will soon be applied in our silk and cotton printing establishments.—[Lon. Morn. Herald.]

Oyster Lamp.—M. de Lavage remarked, on opening an oyster, a shining bluish light, which, on nearer examination, he discovered to be phosphorus. On scooping it out of the shell, it extended nearly half an inch in length, and when immersed in water, seemed in every respect the same as artificially prepared phosphorus. The oyster in which this was discovered was perfectly alive and fresh. The light could not therefore proceed from any decomposition in the shell of the animal, but must have been derived from some other source. Upon examining this phosphorescent substance by the aid of a microscope of considerable power, it was found to consist of various animalculæ, each beautifully luminous, like miniature glow-worms, lighting up their starry lamps to illuminate the dark solitary chamber of the shell, and intended, perhaps, to lure within its reach such marine inhabitants as it might prey upon.

Blasting Rocks.—As many lives are yearly lost by the untimely explosion of the powder used for blasting rocks, humanity prompts us to give a process as we heard it described a few days since, by a person who had been injured in a mine where many accidents of the kind had happened, which led them to try other methods of charging the rocks than those commonly practised, and which he said ended in the discovery of a safe and expeditious manner of blasting. As these accidents had uniformly happened in what he denominated the "tamping" or driving down the brick and other substances used in filling above the powder, they, for an experiment, substituted plaster of Paris, which had been heated, as for preparing cement, which they mixed with water in the same manner, and poured the cement into the hole upon the powder, having first introduced the quill or fuze; the cement immediately set or hardened, when the blast was ready for firing. He said that he never knew a blast managed in this way to fail of doing well, and never knew an accident happen; that it was quicker done, and was more economical in every respect. If this should prove correct, it should be generally introduced.—[Gen. Farmer.]

Mud Walls.—Mr. Loudon, in his Notes on Country Seats, observes, "Mr. Stanley assured us that, when built on good flint or brick foundations, and well thatched, with the eaves projecting so far as completely to throw off the rain, these walls will last for an unknown length of time. They are very common in Wiltshire, and make excellent farmyard as well as garden walls, and the warmest of all cottages. In our Encyc. of Architecture, § 839 to 843, will be found a detailed description of the mode of building cob walls in Devonshire, where houses two or three stories high are built in this way. This account was sent us by a clergyman, who states, as a proof of their great durability, that he was himself born in a cob parsonage, built in the time of Elizabeth. The Devonshire mode, and that practised in Wiltshire, appear to be exactly the same. The Cambridgeshire mode is different, and is also given in the work referred to, § 159. The French mode (pise,) which is more elaborate, will be found in our Architectural Magazine, vol. i., as applicable to one of the most economical designs for a group of four roadside cottages (by Mr. Wilds, surveyor, Hertford,) which we have anywhere seen. We would not, however, be understood as recommending cob, mud, or pise walls, either for cottages, or any thing else, where brick or stone can be procured; but we should certainly prefer them to log-houses, as being safer from fire, warmer in winter, and cooler in summer."

Dyeing Maple or Satin Wood.—Embellishing maple or satin wood with cochineal is an old Swedish practice. In that country, they use knotty pieces and roots of the birch, which they appear to plane with a plane that is not very sharp, so as to throw up the fibre more in some places than in others; they then dip these thin boards into dyes of various kinds, and as the raised fibres imbibe color faster than the smooth cut parts, a delicate variety of tint is easily produced. The boards, when dry, are smoothed and varnished, and make very beautiful furniture.

Best Preparation of Black Lead for cleaning Stoves.—Mix powder of black lead with a little common gin, or the dregs of red port wine, and lay it on the stove with a piece of linen rag; then with a clean, dry and close, but not hard brush, dipped in dried black lead powder, rub it to a beautiful brightness. This will be found to produce a much finer and brighter black varnish on the cast iron, than either boiling the black lead with small beer and soap, or mixing it with white of egg, &c., which are the methods commonly practised.—[Domestic Encyclopedia.]

Cheap Mode by which Farmers and others may manufacture Charcoal.—Provide a hollow cylindrical cast iron back log for the fireplace, not so long but that it may become heated throughout its length. One end may be permanently closed and the other covered with a cap. Drill small holes in it from one end to the other, about a line in diameter. Fill this back log with blocks of wood or chips, and put on the cap. When heated, the inflammable air and tar that issue from the holes will aid the fire. In defect of a cast iron log, a joint of stove pipe may answer temporarily.

Preservation of Meat.—Meat may be preserved fresh many months by keeping it immersed in molasses. A joint of meat, or any provision, suspended in a flannel bag, will keep sweet much longer than by most of the modes commonly practised. The cooler and dryer the meat is when the flannel is put round it the better, and the flannel should be perfectly clean. Fresh meat put in a close vessel containing vinegar, will be preserved a considerable time. Tainted meat will be rendered good by pickling it in pearl-ash water some time. Before it is cooked, however, it should be dipped in vinegar a short time, and then salted in brine.

To give to New Cheese the Flavor of Old.—If it be required to communicate to a new cheese the flavor and appearance of an old one, it may be done by the insertion in the new cheese of portions of the old one containing blue mould. The little scoop which is used in taking samples of cheese is a ready made means of performing the operation, by interchanging ten or a dozen of the rolls which it extracts, and placing them so as to disseminate the germ of the blue mould all over the cheese. A new Stilton cheese, treated in this way, and well covered up from the air for a few weeks, becomes thoroughly impregnated with the mould, and generally with a flavor hardly to be distinguished from the old one. I have sometimes treated half a Lancashire cheese in this way, and have left the other half in its natural state, and have been much amused with the remarks of my friend on the striking superiority of the English over the Scotch one.—[Agricultural Journal.]

On preserving Wood from Decay, Dry Rot, &c.

Fredericksburg, Va., Nov. 10, 1834.

To the Editor of the Railroad Journal, &c.

Sir,—In answer to your inquiry, for "a cheap and an effectual method of preserving wood from decay, and destruction by worms, dry rot, &c.," I have resumed a course of experiments on this subject, which I commenced in the summer of 1830; and trust that I shall soon be able to satisfy the public that the thing is both practicable and economical. I find my experiments confirmed, in my own mind, at least, by a careful examination of the petrifying earths and waters of Virginia. We have only to follow in the simple path of nature, and we see at once how the operation is performed. I will not at this time enter into the nature and cause of the dry rot, &c. Whether it is a little fungus, that lives and derives its nourishment from the tree within, as the mistletoe does from the tree without—or whether it is a chemical change, produced by absorption of moisture,—I leave for others to determine. It is sufficient to say that there is a principle of decay in most timber, which is more or less active whenever the wood is exposed to the atmosphere and moisture. There is also a saccharine principle, which is the food of worms; and there is also a process of fermentation which hastens its destruction.

This fermentation must be prevented; this saccharine principle must be destroyed; and the pores of the wood must imbibe some material which will effectually fortify it against moisture and the chemical action of different earths and atmospheres. The process by which I effect this is comparatively cheap and simple. I have obtained a patent for the same, and am now ready to receive proposals for furnishing timber of all descriptions for purposes where durability is especially required. If the timber does not answer the end proposed, or endure a certain number of years, according to contract, I will engage, and give security, to refund the amount expended in the experiment.

Some specimens of sapling pines, which I have carried through the process of preservation, and which have since been exposed, are now without the least appearance of decay, while the remainder of the same tree, alike exposed, is already in ruins.

Very respectfully, yours,

Forrest Shepherd.

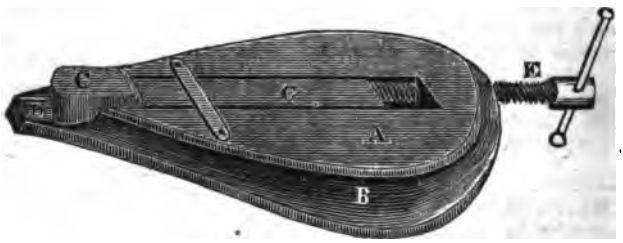
Specification of the Patent granted to JOHN PAUL NEUMANN, *of Cornhill, in the City of London, Merchant, for certain Improvements in making or producing Leather from Hides and other Skins.* Sealed December 21, 1833.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said John Paul Neumann, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, (that is to say):

The novelty and utility of the new invention communicated to me by a certain foreigner, residing abroad, consists in employing the hop plant, whether root, stalks, or leaves, or any part thereof, either in a green or dry state; but I prefer the use of the plant in a dry state, and for the sake of economy, I give the preference to the stalks and the roots; but be it understood, although I prefer the hop plant, or any part thereof, to be used by itself for the purpose of tanning, yet they may be used in conjunction with any vegetable containing tanning matter. The mode to which I give the preference for this plant to be used for the purpose of tanning, is to grind or reduce it as fine as practicable, and, when so prepared, it may be employed for every mode of tanning in the same manner as oak bark, or any other vegetable containing tanning matter. According to circumstances of different hides or skins, this tanning matter may be applied either warm or cold, whether in extract or mixed with other matter; every practitioner in tanning will soon perceive which mode is most applicable for the different hides or skins which he means to subject to the process of tanning, as hides and skins require different modes of treatment; with some it is necessary to use heat or warmth, and others cold; but I prefer to have the hides or skins prepared in the usual mode hitherto followed by practical tanners.

The principal novelty of this invention consists in using the hop plant for tanning, which hitherto has never been employed for that purpose; and by means of this process it will be rendered both useful and valuable for the purpose of tanning.—In witness whereof, &c.

Enrolled June 20, 1833.



Patent Collar Block, of Dyer Cleaveland, of Oswego, Tioga county, N. Y. Letters patent secured on the 13th day of September, 1834.

They are made either of wood or cast iron; if of wood, in the following manner: First, a block of wood is formed to the shape seen in the engraving, about twenty-two inches long, sixteen inches wide, and about eight inches thick; the upper surface, A, in the widest place, is eight inches, and about sixteen inches in length, and the under part of the block, at B, is four inches wider, and extends in a proportional width all round the upper part, A, and is formed in a concave manner, so that it will fling the belly of a collar out, and form it into a proper shape to fit and set easy on a horse. C is a piece of wood that is moveable in a channel cut out in the upper surface of the block, to the depth of about four inches, in which the piece of wood, C C, moves back and forth by the operation of the screw E, that enters the end of the block and comes in contact with the sliding piece of wood C C, and driving it into the end of the collar, draws it tight to the block, and gives to the collar the requisite form and stretching, thereby ridding the collar of all wrinkles. D represents the end of the channel.

It is the opinion of some of the best judges that this machine far surpasses any thing of the kind that has been offered to the public, it being more simple in its construction, and far more convenient and complete in its operation, as it does its work in a perfect manner. After the collar is sewed together, it can with the greatest ease and pleasure be blocked in perfect form in five minutes,

and there is no necessity of roping the collar on this machine.

N. B.—It is obvious that a collar cannot be blocked on Messrs. Post's and Whitney's machines without the rope, and then always before the collar is sewed together, which leaves the collar imperfectly formed.

Pratt's Patent Churning Machine.—Invention has been on the stretch for many years to produce the best plan for a churning machine. Mr. Pratt has hit upon a contrivance, simple, but at the same time so effective, that a child can do the thing required. Mr. Pratt has the most ample testimonials from Dr. Hosack, Peter R. Livingston, &c. &c. of the practical utility of his invention. After ample experience, they pronounce it the most perfect machine they have ever seen for facilitating the operation of churning. Such, say they, is the power, that a boy of ten years of age can churn a barrel of milk without fatigue.

The machine, the certificates of its practical utility, and the terms on which individuals, towns, counties, and states, may be purchased, are to be seen at No. 41 Courtlandt street, New-York.

Patent Sash Lines.—These sash lines are nothing more nor less than braided lines manufactured by machinery, and may be made of cotton, wool, flax, hemp, or any staple that can be formed into thread. The cost is little more than twisted ropes or lines. Articles braided in this manner will not be subject to kinks, nor to untwisting, and of course will be stronger than lines. It would, we should suppose, be preferable to the common ropes for rigging of vessels. The number of strands may be as numerous as is thought advisable. We see no reason why these lines or ropes should not supersede the common ones for a great variety of purposes, such as halters, traces, harness, &c. We are assured Mr. Mann, at the corner of Stanton and Cannon streets, is the only manufacturer of this article in this city. A sample of these cords is left at the office of the American Institute, No. 41 Courtlandt street, New-York, for inspection.

New Moving Power.—At a meeting of the French Academy of Sciences on the 16th of June, a very interesting communication was read from M. Thilorier, a skilful chemist, who exhibited to the Academy the apparatus by which he procured a litre (two pints) of liquid carbonic acid in a few seconds. The properties of this substance, he observed, have been but little examined, chiefly because it requires to be confined in close vessels, hermetically sealed, and capable of resisting a great pressure. It surpasses all known bodies in the expansion and contraction which it undergoes from given variations of temperature. By raising the temperature from 0 to 30 centigrade (32 to 86 of Fahrenheit) a column of the liquified gas is elongated one half. With the same change of temperature, a similar column of air is only elongated one eighth. This enormous dilatation, M. Thilorier thinks, will in future afford the elements of a moving power infinitely more effective, as well as economical, than that which is derived from the expansion of vapor.

New Invention—*The Proverb realized, "the Cart before the Horse."*—In the month of May last, there was seen, in the streets of Manheim, a horse pushing before him a carriage, guided with much address by Baron Drais, the author of this invention, which is attended with great advantages: 1. The horse cannot run away. 2. The carriage is not exposed to the dust and dirt generally thrown up by the horse. 3. The prospect is not interrupted by the coachman and the horses. 4. The conversation of the travellers cannot be overheard by the coachman. 5. The travellers are not incommoded by the fumes of the tobacco, &c. The coach-box will be placed on the roof of the carriage, behind, and by means of a looking glass the driver is able to guide the vehicle. This invention is applicable to carriages drawn by four horses.—Heidelburg, Aug. 15.

Improved Lights.—A new method of diffusing light through a theatre has been discovered by a mechanist at Venice. By the aid of parabolic mirrors, the light of many lamps is concentrated over an opening made in the ceiling of the theatre, and reflected down on a system of plano-concave lenses, of a foot in diameter, which occupy the

aperture, and convey into the theatre the rays of light, which arrive at them parallel and depart from them divergent. From the pit the lenses are alone perceived, which resemble a glowing furnace; and although the luminous focus is sufficient to light the whole of the theatre, it does not dazzle, and may be viewed without fatiguing the eyes. The apparatus being entirely concealed, accommodates itself readily to all the changes which the representation can require. It likewise occasions neither smoke nor bad odors, and has none of the inconveniences of the ancient system.

An Economical Substitute for Copying Machines.—In the common ink used for writing dissolve with it one drachm of loaf sugar to each ounce of ink; moisten a sheet of unsized paper to copy with, and put it between two sheets of the same paper, to absorb the superfluous moisture; then put the moistened paper on the writing, when by passing a roller once or twice over its surface, you will have a perfect fac-simile struck on the copy paper, without injuring the original in the least.—[Eclectic Journal of Science.]

Purification of Wine.—Plaster of Paris (*gypsum*) is excellent for rendering thick, turbid wine, clear and pure from foreign matter. This method of clarifying wines was well known to the Greeks and Romans, who always put it into new wine, where it was suffered to remain some time. It improves the flavor too, and this fact they understood. Put a small quantity of the gypsum flour into each bottle, and having shaken it a little, set it away till the liquor is needed for use.—[Scientific Tracts and Lyceum.]

A Profitable Garden.—There is a garden called Shah Chiragh in the neighborhood of Shiraz, in Persia, in which is the tomb of the brother of an imam, who was suddenly killed on that spot, at which famous miracles are said to be wrought every Ramazan. The mootuwulli, or proprietor, in whose family the property has been for many ages, finds its supposed sanctity worth, to him, nine thousand dollars a year. To keep a proper degree of zeal alive in the people, he tutors a man for the business, who, for a few months before Ramazan, appears miserably sick, but on that day, there being but one in the whole year on which cures are effected, touches the soil of the garden, and stoutly cries to Ali for help, and then instantly recovers.—[Scientific Tracts.]

Loss of Memory from Gin.—A very sensible writer in a foreign journal relates that his power of memory was partially destroyed by the use of gin, and that he recovered that important faculty simply by leaving off his drams. He has the good sense to say further, and he is a physician, that he has scarcely any confidence in any preparation of alcohol. With us, we could tell the gentleman alcohol is considered a positive poison, never to be touched.—[Ibid.]

Human Strength.—From the result of experiments made in Portsmouth dock-yard, in driving and pressing in large iron and copper bolts, a man of medium strength, striking with a mallet weighing eighteen pounds, and the handle of which was forty-four inches long, would start a bolt about one eighth of an inch every blow. It required a pressure of one hundred and seven tons to press the same bolt down the same quantity of space, but a small additional weight pressed it completely home.

Noble Sentiments.—Lord Erskine was distinguished through life for independence of principle, for his integrity, and for his scrupulous adherence to truth. He once explained the rule of his conduct, which ought to be generally known and adopted. It ought to be deeply engraven on every heart. He said: It was the first command and council of my youth, always to do what my conscience told me to be a duty, and to leave the consequences to God. I shall carry with me the memory, and I trust the practice, of this paternal lesson to the grave. I have hitherto followed it, and have no reason to complain that my obedience to it has been even a temporal sacrifice. I have found it, on the contrary, the road to prosperity and wealth, and I shall point it out as such to my children.

Hybernating Animals.—The bat, hedgehog, dormouse, and marmot, possess all the characteristics of the mammalia, and are only distinguished from others by their hybernation, during which they are converted for a time into cold blooded animals, because their temperature is scarcely higher than that of the atmosphere. Their breathing is irregular, and at long intervals, and no sort of nourishment is taken for several months. A curious field still remains unexplored, relative to the philosophy of this miraculous peculiarity of these particular animals.—[Scientific Tracts.]

Mice.—Naturalists assure us that mice cannot live on the Asiatic side of the Ural mountains. Capt. Cochrane, who travelled

on foot from St. Petersburg into Asia, over the formidable ridge of barren rocks, piled almost to the skies, says that the sable is never found in Asia. He further observes, that the oak will only flourish on the European side. At Ekatherinebourg that intrepid pedestrian visited a gold mine, into which he made an entrance by being let down in a basket to the depth of one hundred and sixty feet. He says that four thousand pounds of the earth brought from the bottom will scarcely yield, when washed, the value of one guinea.—[Ibid.]

HEAT.—If heat, says Dr. Williamson, came in direct rays from the sun, it would follow that the quantity of heat on the surface of every planet would be inversely as the square of its distance from the sun, according to a former opinion. But experiments without number prove that such opinion is unfounded. Although light comes from the sun, and light has the power of exciting heat, it is clear that heat does not come from the sun. The experiment is conclusive in all warm climates, and in every climate where there are high mountains. At the foot of the Andes, near the equator, the inhabitants suffer by the heat of eighty or ninety degrees. Let them ascend the mountain, and before they have arisen two miles, they find themselves in the region of perpetual snow. How should this happen? They are surely nearer the sun on the mountain than upon the plain, and they are subjected to more of his rays; therefore, according to the alleged rule, they should be warmer; but they are, in fact, much colder, because they are in a thinner, or a lighter atmosphere. The issue is the same in all cases where the experiment has been made. On the Peak of Teneriffe, the traveller arrives at the region of frost at the very same height, or under the same weight of the atmosphere, that he finds it upon the Andes. If he could rise but two miles farther, it is not to be questioned that he would, in so thin an atmosphere, perish by the want of heat. Hence we infer that the degree of heat, in every planet, is according to the weight of its atmosphere, compared with its distance from the sun. We also infer that the inhabitants of the several planets cannot enjoy the same degree of heat, unless the weight of their atmosphere be increased according to their several distances from the sun.—[Ibid.]

NUDITY FAVORABLE TO PHYSICAL DEVELOPEMENT.—On the authority of a celebrated writer, it is asserted that in those climates in which nudity is not incompatible with health, the exposure of the whole surface of the body to light is highly favorable to the regular conformation and developement of the body. This observation has been abundantly confirmed by Humboldt, in his voyage to the equinoctial regions. Deformity, and deviations from exact proportions and symmetry, are extremely rare in those races possessing dark skins, and particularly so in those who wear little or no clothing. He regards the influence of light upon the skin of as much real importance to the healthful condition of the individual, as wholesome air in the lungs. How far this conclusion is warranted by facts, future philosophers will probably determine.—[Ibid.]

THE BLACK DEATH.—This great pestilence of the fourteenth century swept away, in four years, a fourth of the entire population of Europe. Indications of some dreadful calamity preceded the destroying malady, for more than fifteen years. Parching droughts were followed by torrents of rain, unprecedented since the flood. Four hundred thousand were drowned in the capital of Kingsai, by the sudden rise of the rivers Kaing and Hoai. The mountain of Tsinchcou was washed from its very foundations, and left vast chasms in the earth. One year after, 1334, the neighborhood of Canton was inundated, while in Tche, after an unexampled drought, a plague arose, which swept off, with irresistible force, about five millions of people. When the black death reached England, both the air and the water were so saturated with something destructive to animal life, that fishes died in the rivers, and five thousand cattle died in one pasture. It maintained its empire from 1347 to 1350, with unabated fury.—[Ibid.]

COMMERCE.—The three countries with which the United States have the most commerce, are England, France, and Cuba. The imports from England in 1833 amounted to $36,668,315; from France, $13,431,678; and from Cuba, £9,754,787. The exports were to England, $31,935,441; to France, $13,772,221; to Cuba, $5,662,700. The States which carry on the greatest foreign commerce are New-York, Massachusetts, Pennsylvania, Louisiana, and Maryland. The principal ports are New-York, Boston, Philadelphia, New-Bedford, New-Orleans, Portland, and Baltimore. The tonnage of New-York is nearly 300,000; that of Baltimore 47,000. The chief articles of export are cotton, tobacco, flour, rice, and pork, the cotton amounting to 36 millions, the pork to 2 millions.

[From the American Railroad Journal.]

On the Substitution of Locks for Inclined Planes and Stationary Steam Engines, on Railroads.

To the Editor, &c.

Sir,—It is a desideratum with engineers and railroad companies, to discover a substitute on railways for inclined planes and stationary steam engines. This mode of ascending elevations is noticed and deprecated by Geo. W. Smith, Esq., editor of Wood's American edition on Railroads, in the following remarks.

"Stationary steam engines on inclined planes are an opprobium to the present advanced state of the science of civil engineering—they are exceedingly inconvenient, expensive, and dangerous. If the plane be steep, the locomotive engine cannot be advantageously drawn up with the waggons they have conducted to the foot of the plane; the great inconvenience of this system is too apparent to require comment. Hence, any available plan, which will *enable locomotive* engines to ascend inclined planes, with their *full complement* of waggons, will be a most valuable addition to the utility of railroads." He adds, "unless the height to be overcome be great, compared with the length of the whole line of railway, the delay resulting from the diminution of speed will be a trivial inconvenience, when the advantages of dispensing with an expensive stationary power are estimated."

We have not yet experienced the same fatal effects from inclined planes and stationary engines that they have in England, where many lives have been sacrificed by that mode of elevating. Some accidents have occurred in the United States, and they will probably multiply as inclined planes increase, until they produce the same appalling effects they have, and daily do, in Great Britain. There is no question but inclined planes, and stationary steam power, are not only the most expensive, but the most dangerous, parts of a railroad, and the individual who discovers a less dangerous and expensive substitute, though not as speedy, will deserve well of the community. It is rumored that a mode of ascending by locks is contemplated by some gentlemen in this city, and a patent has been, or is intended to be, obtained for the invention. I cannot discover any great difficulty of ascending acclivities by locks, at a much less *original* expense than excavating and furnishing them for inclined planes; but whether the danger and subsequent expense are diminished in the same proportion with the speed—(for locks must be a slower mode of elevating)—is not obvious. It is a subject of much interest to the community, and any probable method of surmounting elevations, than by inclined planes and stationary engines, merits attention and investigation. I feel some solicitude, Mr. Editor, to hear or see more of this lock project, and the inventor has my best wishes for the ultimate attainment, by locks or otherwise, of an elevating power, combining greater economy with less hazard, than the one now in use.

A Subscriber.

Memoir of Robert Fulton.

WHO WAS THE INVENTOR OF STEAM NAVIGATION?

[From Dunlap's History of the Rise and Progress of the Arts of Design in the United States.]

The parents of this gentleman were of Irish origin: the father, a native of Kilkenny—the mother a Pennsylvanian, by name Smith, and descended from Hibernian emigrants. Robert was the oldest of two sons: he had three sisters, two older than himself. He was born in Little Britain, in the county of Lancaster, Pennsylvania, in 1765, and showed early indications of his attachment to mechanics; but was, as a youth, still more devoted to the pencil. He commenced the painting of portraits and landscapes, as a profession, at the age of seventeen; that is, in the year 1782, and continued so employed until 1785. During this period, Charles Wilson Peale was the principal painter in Philadelphia, until Pine's arrival; and doubtless Fulton did not neglect the instruction to be derived from them and their pictures.*

Robert Fulton, at the age of 21, had, by his industry and frugality, enabled himself to purchase a little farm in Pennsylvania, on which he established his mother, and soon after crossed the Atlantic to seek instruction from Benjamin West. That Mr. West justly appreciated the character of his young countryman, is attested by his presenting him with two pictures: one representing the great painter with his wife's portrait on his easel; and the other Fulton's own portrait.

Mr. Fulton, perhaps by invitation, practised as a portrait painter in Devonshire, and here appears to have revived his attachment to mechanics. Canal navigation attracted his attention, as he here became acquainted with the Duke of Bridgewater, and they became united by their mutual love of science. Lord Stanhope and Fulton were attracted to each other by similar propensities. In 1793 was published a print, engraved by Sherwin, from a picture by Fulton, of Louis XVI. in prison, taking leave of his family. The only copy I have seen is possessed by my friend Dr. Francis: it is now a curiosity. As early as 1793, Fulton's mind was engaged in projects to improve inland navigation. In 1794 he obtained a patent for a double inclined plane, and other patents, from the

* "Robert Fulton," says Edward Everit, "was a portrait painter in Pennsylvania, without friends or fortune." A school-fellow of Fulton says, "Robert Fulton was a school-boy in Lancaster, Pennsylvania; his mother then a widow. He borrowed paints and brushes of another, and soon excelled, but neglected his books. He was sent to Philadelphia, to a silversmith; but not liking, he went to London."

British government. For eighteen months he resided in Birmingham, and improved his knowledge of mechanics in that great workshop.

In 1795 he published several essays, which elicited the compliments and recommendations of Sir John Sinclair and the Board of Agriculture. The profession of a painter was abandoned, and his knowledge of the art of design applied to drawings on the subjects which now engaged his mind.

In the year 1797 Mr. Fulton had apartments in the same Parisian hotel with Joel Barlow; and a friendship was then formed between these two eminently gifted and amiable individuals, which was only broken by death. When Mr. Barlow established himself in a style befitting his public station, in a hotel appropriated to himself and lady, he invited Fulton to make one of his family. Here he resided seven years, during which he studied the modern languages, and the higher branches of science. During this time Fulton also projected a panorama, in imitation of Barker. It had some success, and is said to have been the first seen in Paris. But his mind was occupied with other projects, particularly the explosion of gunpowder under water. His torpedoes were offered to the French and Dutch governments; and when Bonaparte became first consul, he appointed a commission to examine Fulton's plans, and assist in making experiments.

When chancellor Livingston arrived in Paris, the intimacy between him and Fulton commenced, which led to the fulfilment of his destinies, by the accomplishment of steam navigation.

If the failure of Mr. Fulton's schemes for the destruction of ships of war, by torpedoes, fixed his attention upon navigating vessels by steam, we may congratulate the world that the conflicting nations of Europe, to whom with perfect indifference he seems to have offered his projects and services, for the destruction of their enemies, did not accept of them. If, as we believe, the views of Mr. Fulton were to banish naval warfare from the world, perhaps that change which will take place in defensive warfare, by the use of the steam frigate, such as Fulton built at New-York, in harbors and on coasts, may go far to answer the same end.

In 1801 Mr. Fulton repaired to Brest, to make experiments with the plunging boat he had constructed the preceding winter. This, as he says, had many imperfections, natural to a first machine of such complicated combinations. Added to this, it had suffered much injury from rust, in consequence of his having been obliged to use iron instead of brass or copper, for bolts and arbors.

Notwithstanding these disadvantages, he engaged in a course of experiments with the machine, which required no less courage than energy and perseverance. Of his proceedings he made a report to the committee appointed by the French executive; from which report we learn the following interesting facts:

"On the 3d July, 1801, he embarked with three companions on board his plunging boat in the harbor of Brest, and descended in it to the depth of five, ten, fifteen, and to twenty-five feet; but he did not attempt to go lower, because he found that his imperfect machine would not bear the pressure of a greater depth. He remained below the surface one hour. During this time they were in utter darkness. Afterwards he descended with candles; but finding a greater disadvantage from their consumption of vital air, he caused previously to his next experiment a small window of thick glass to be made near the bow of his boat, and he again descended with her on the 24th of July, 1801. He found that he received from his window, or rather aperture covered with glass, for it was no more than an inch and a half in diameter, sufficient light to enable him to count the minutes on his watch. Having satisfied himself that he could have sufficient light when under water; that he could do without a supply of fresh air for a considerable time; that he could descend to any depth, and rise to the surface with facility; his next object was to try her movements, as well on the surface as beneath it. On the 26th of July he weighed his anchor and hoisted his sails: his boat had one mast, a mainsail, and jib. There was only a light breeze, and therefore she did not move on the surface at more than the rate of two miles an hour; but it was found that she would tack and steer, and sail on a wind or before it, as well as any common sailing boat. He then struck her mast and sails; to do which, and perfectly to prepare the boat for plunging, required about two minutes. Having plunged to a certain depth, he placed two men at the engine which was intended to give her progressive motion, and one at the helm, while he, with a barometer before him, governed the machine, which kept her balanced between the upper and lower waters. He found that, with the exertion of one hand only, he could keep her at any depth he pleased. The propelling engine was then put in motion, and he found, upon coming to the surface, that he had, in about seven minutes, made a progress of

four hundred metres, or about five hundred yards. He then again plunged, turned her round while under water, and returned to near the place he began to move from. He repeated his experiments several days successively, until he became familiar with the operation of the machinery, and the movements of the boat. He found that she was as obedient to her helm under water, as any boat could be on the surface; and that the magnetic needle traversed as well in the one situation as the other.

"On the 7th of August Mr. Fulton again descended, with a store of atmospheric air compressed into a copper globe of a cubic foot capacity, into which two hundred atmospheres were forced. Thus prepared, he descended with three companions to the depth of about five feet. At the expiration of an hour and forty minutes, he began to take small supplies of *pure* air from his reservoir, and did so as he found occasion, for four hours and twenty minutes. At the expiration of this time he came to the surface, without having experienced any inconvenience from having been so long under water.

"Mr. Fulton was highly satisfied with the success of these experiments; it determined him to attempt to try the effects of these inventions on the English ships which were then blockading the coast of France, and were daily near the harbor of Brest.

"His boat at this time he called the submarine boat, or the plunging boat; he afterwards gave it the name of the Nautilus; connected with this machine were what he then called submarine bombs, to which he has since given the name of torpedoes. This invention preceded the Nautilus. It was, indeed, his desire of discovering the means of applying his torpedoes, that turned his thoughts to a submarine boat. Satisfied with the performance of his boat, his next object was to make some experiments with the torpedoes. A small shallop was anchored in the roads, with a bomb containing about twenty pounds of powder; he approached to within about two hundred yards of the anchored vessel, struck her with the torpedo, and blew her into atoms. A column of water and fragments was blown from eighty to one hundred feet in the air. This experiment was made in the presence of the prefect of the department, Admiral Villaret, and a multitude of spectators.

"The experimental boat of Mr. Livingston and Mr. Fulton was completed early in the spring of 1808: they were on the point of making an experiment with her, when one morning, as Mr. Fulton was rising from a bed in which anxiety had given him but little rest, a messenger from the boat, whose precipitation and apparent consternation announced that he was the bearer of bad tidings, presented himself to him, and exclaimed in accents of despair, "Oh, sir, the boat has broken in pieces and gone to the bottom!" Mr. Fulton, who himself related the anecdote, declared that this news created a despondency which he had never felt on any other occasion; but this was only a momentary sensation. Upon examination, he found that the boat had been too weakly framed to bear the great weight of the machinery, and that in consequence of an agitation of the river by the wind the preceding night, what the messenger had represented had literally happened. The boat had broken in two, and the weight of her machinery had carried her fragments to the bottom. It appeared to him, as he said, that the fruits of so many months' labor, and so much expense, were annihilated; and an opportunity of demonstrating the efficacy of his plan was denied him at the moment he had promised it should be displayed. His disappointment and feelings may easily be imagined; but they did not check his perseverance. On the very day that this misfortune happened, he commenced repairing it. He did not sit down idly to repine at misfortunes which his manly exertions might remedy, or waste, in fruitless lamentations, a moment of that time in which the accident might be repaired. Without returning to his lodgings he immediately began to labor with his own hands to raise the boat, and worked for four and twenty hours incessantly, without allowing himself rest, or taking refreshment: an imprudence which, as he always supposed, had a permanent bad effect on his constitution, and to which he imputed much of his subsequent bad health.

"The accident did the machinery very little injury; but they were obliged to build the boat almost entirely new; she was completed in July: her length was sixty-six feet, and she was eight feet wide. Early in August Mr. Fulton addressed a letter to the French National Institute, inviting them to witness a trial of his boat, which was made in their presence, and in the presence of a great multitude of the Parisians. The experiment was entirely satisfactory to Mr. Fulton, though the boat did not move altogether with as much speed as he expected. But he imputed her moving so slowly to the extremely defective fabrication of the machinery, and to imperfections which were to be expected in the first experiment with so complicated a machine, but which he saw might be easily remedied."

Mr. Fulton returned home in 1806, and renewed his efforts to prove that he could destroy vessels by invisible means, and the next year he made an experiment upon a hulk anchored in New-York harbor for the purpose. The owner of the hulk having consented, the experiment was fully successful. In 1810 the United States made an appropriation for trying the effect of torpedoes and other submarine explosions. The experiments were made upon the sloop of war Argus, Capt. Lawrence, and failed. Mr. Fulton's friends still thought, or said, that the experiments would be successful. Commodore Rogers thought and reported them altogether impracticable.

We all know that Fulton was not the first who propelled a boat by steam, but we know that we owe to him those inventions which remedied the failures of former experimenters, and, in fact, by his genius and skill, created the steamboat. Fulton was assisted by friends with advice and funds; but Fulton's was the mind and the perseverance which gave to the world a mode of conveyance, for speed, ease, and certainty, so powerful in its influence on travelling and commerce, as to have advanced civilization on its destined progress beyond any former gift bestowed upon man, printing excepted. He thus writes to his friend, Joel Barlow: "New-York, August 2, 1807. My dear friend, my steamboat voyage to Albany and back has turned out rather more favorable than I had calculated. The distance from New-York to Albany is 150 miles; I ran it up in thirty-two hours, and down in thirty hours, the latter is five miles an hour. I had a light breeze against me the whole way going and coming, so that no use was made of my sails, and the voyage has been performed wholly by the power of the steam engine. I overtook many sloops and schooners, beating to windward, and passed them as if they had been at anchor.

"The power of propelling boats by steam is now fully proved. The morning I left New-York, there was not perhaps thirty persons who believed that the boat would move a mile an hour, or be of the least utility; and while we were putting off from the wharf, which was crowded with spectators, I heard a number of sarcastic remarks. This is the way, you know, in which ignorant men compliment what they call philosophers and projectors.

"Having employed much time and money, and zeal, in accomplishing this work, it gave me, as it will you, great pleasure to see it so fully answer my expectations. It will give a cheap and quick conveyance to merchandise on the Mississippi and Missouri, and other great rivers, which are now laying open their treasures to the enterprise of our countrymen. And although the prospect of personal emolument has been some inducement to me, yet I feel infinitely more pleasure in reflecting with you on the immense advantage my country will derive from the invention."

Thus the first voyage, and that perfectly successful, was made in thirty-two hours from New-York to Albany. In consequence of this first voyage it is now made in nine hours.

Surely the discoverer enjoys a pleasure greater and purer than any other human being can enjoy. We mean the discoverer who has just views of the great advantages which will result from the successful termination of his researches. Not to mention many others, let us reflect upon the pure and intense joy of Columbus, when he landed on St. Salvador—of Franklin, when he succeeded in drawing the lightning, innocuous, from the thunder cloud—of Worcester, when convinced of the power of steam—and of Fulton, when he saw, felt, knew, that he could triumph over winds and tides, by machinery of his own invention—when he heard the acclamations of the scoffers, and received the praises of the wise.

"He published his work, entitled 'Torpedo War, or Submarine Explosions.' He adopted as a motto for his publication, his favorite sentiment, 'The liberty of the seas will be the happiness of the earth.' He addressed it to the President of the United States, and to the members of both houses of Congress. It contained a description of the experiments he had made, of his engines as he had improved them, and of the manner in which they might be used. He expressed the most sanguine expectations as to the effects they would produce, when they had attained the improvements of which he believed them capable, and had the advantage of practice, by which gunnery, and other modes of warfare, had been brought to their present perfection." Fulton's ideas respecting submarine guns led to the invention of the steam frigate.

"He communicated to Mr. Jefferson an account of his experiments on submarine firing, with drawings of his various plans. Mr. Jefferson expressed himself much pleased with this novel mode of maritime warfare, and assured Mr. Fulton that he would recommend it to the attention of government.

"It is curious to observe how Mr. Fulton's projects grew one out of another.

"The submarine guns gave rise to the steam man-of-war.

"It having been suggested by a distinguished naval officer, before alluded to, that in approaching an enemy so near as was necessary to give effect to submarine cannon, the vessel, if she was rigged in the ordinary way, would be liable to be entangled with her adversary; to meet this objection, Mr. Fulton proposed to move the vessel by steam. His reflections on this project, and what he saw of the performance of so large a vessel as the Fulton, her speed, and the facility with which she was managed, led him to conceive, that a vessel of war might be constructed, in which, to all the advantages possessed by those now in use, might be added the very important ones which she would derive from being propelled by steam as well as by the winds."

The character of Mr. Fulton is elucidated by an incident given thus in Colden's life of him:

"We must all remember how long, and how successfully, Redheffer had deluded the Pennsylvanians by his perpetual motion.

"Many men of ingenuity, learning, and science, had seen the machine: some had written on the subject; not a few of these were his zealous advocates; and others, though they were afraid to admit that he had made a discovery which violated what were believed to be the established laws of nature, appeared also afraid to deny what the incessant motion of his wheels and weights seemed to prove. These contrived ingenious theories, which were hardly less wonderful than the perpetual motion itself. They supposed that Redheffer had discovered a means of developing gradually some hidden power, which, though it could not give motion to his machine for ever, would keep it going for some period, which they did not pretend to determine.

"One of these perpetual motions commenced its career in this city* in eighteen hundred and thirteen. Mr. Fulton was a perfect unbeliever in Redheffer's discovery, and although hundreds were daily paying their dollar to see the wonder, Mr. Fulton could not be prevailed upon for some time to follow the crowd. After a few days, however, he was induced by some of his friends to visit the machine. It was in an isolated house in the suburbs of the city.

"In a very short time after Mr. Fulton had entered the room in which it was exhibited, he exclaimed, 'Why, this is a crank motion.' His ear enabled him to distinguish that the machine was moved by a crank, which always gives an unequal power, and therefore an unequal velocity in the course of each revolution: and a nice and practised ear may perceive that the sound is not uniform. If the machine had been kept in motion by what was its ostensible moving power, it must have had an equable rotary motion, and the sound would have been always the same.

"After some little conversation with the showman, Mr. Fulton did not hesitate to declare that the machine was an imposition, and to tell the gentleman that he was an impostor.

"Notwithstanding the anger and bluster which these charges excited, he assured the company that the thing was a cheat, and that if they would support him in the attempt, he would detect it at the risk of paying any penalty if he failed.

"Having obtained the assent of all who were present, he began by knocking away some very thin light pieces of lath, which appeared to be no part of the machinery, but to go from the frame of the machine to the wall of the room, merely to keep the corner posts of the machine steady.

"It was found that a catgut string was led through one of these laths and the frame of the machine to the head of the upright shaft of a principal wheel; that the catgut was conducted through the wall, and along the floors of the second story, to a back cock-loft, at a distance of a number of yards from the room which contained the machine, and there was found the moving power. This was a poor old wretch, with an immense beard, and all the appearance of having suffered a long imprisonment; who, when they broke in upon him, was unconscious of what had happened below, and who, while he was seated on a stool, gnawing a crust, was with one hand turning a crank.

"The proprietor of the perpetual motion soon disappeared. The mob demolished his machine, the destruction of which immediately put a stop to that which had been, for so long a time, and to so much profit, exhibited in Philadelphia."

In the year 1806, Mr. Fulton married Miss Harriet Livingston, daughter of Walter Livingston, Esq. One son and three daughters were the fruit of his marriage. In 1815 Mr. Fulton was examined as a witness in a steamboat cause, at Trenton.

"When he was crossing the Hudson to return to his house and family, the river was very full of ice, which occasioned his being several hours on the water in a very severe day. Mr. Fulton had not a constitution to

* New-York.

encounter such exposure, and upon his return he found himself much indisposed from the effects of it. He had at that time great anxiety about the steam-frigate; and after confining himself for a few days, when he was convalescent, he went to give his superintendence to the artificers employed about her: he forgot his debilitated state of health in the interest he took in what was doing on the frigate, and was a long time, in a bad day, exposed to the weather on her decks. He soon found the effects of this imprudence. His indisposition returned upon him with such violence as to confine him to his bed. His disorder increased, and on the twenty-fourth day of February, eighteen hundred and fifteen, terminated his valuable life.

"It was not known that Mr. Fulton's illness was dangerous till a very short time before his death, which was unexpected by his friends, and still more so by the community. As soon as it was known, all means were taken to testify, publicly, the universal regret at his loss, and respect for his memory. The newspapers that announced the event, had those marks of mourning which are usual in our country when they notice the death of public characters. The corporation of our city, the different literary institutions, and other societies, assembled, and passed resolutions expressing their estimation of his worth, and regret at his loss. They also determined to attend his funeral, and that the members should wear badges of mourning for a certain time.

"As soon as the legislature, which was then in session at Albany, heard of the death of Mr. Fulton, they expressed their participation in the general sentiment, by resolving that the members of both houses should wear mourning for some weeks.

"This is the only instance we believe of such public testimonials of regret, esteem, and respect, being offered on the death of a private citizen, who never held any office, and was only distinguished by his virtues, his genius, and the employment of his talents.

"He was buried on the 25th day of February, 1815. His corpse was attended from his last residence, (No. 1 State street,) by all the officers of the national and state governments then in the city, by the magistracy, the common council, a number of societies, and a greater number of citizens than had been collected on any similar occasion. From the time the procession began to move, till it arrived at Trinity Church, minute guns were fired from the steam-frigate and the West Battery. His body, in a leaden coffin, covered with plain mahogany, on which is a metal plate engraved with his name and age, is deposited in a vault belonging to the Livingston family."

As a painter Mr. Fulton does not rank high. Probably his best picture is the portrait of his friend Barlow. We owe to him the splendid edition of Barlow's Columbiad. Mr. Colden says:

"The elegant plates which adorn that work were executed under the superintendence and advice of Mr. Fulton. He paid about five thousand dollars for the paintings, the plates, and letter press, which gave him a property in the publication. He relinquished, by his will, all his right to the widow of Mr. Barlow, with the reservation of fifty of the proof and embellished copies of the work. It was printed in Philadelphia, in quarto, and published in 1807; it is dedicated by Mr. Barlow to Mr. Fulton, in such terms as evince the strong attachment which subsisted between these men of genius. The original paintings, from which the prints of the Columbiad were engraven, form a part of the handsome collection which Mr. Fulton has left to his family."

We owe to him the introduction into this country of the pictures painted by his friend and master, West, from Lear and Hamlet, for Boydell's Shakspeare. The Lear cost him two hundred and five guineas, and the Ophelia one hundred and twenty-five, at Boydell's sale. At the same time he purchased a fine picture by Raphael West, from "As you like it." West's pictures were painted for Boydell, and his great project failing, the government allowed his pictures to be disposed of by a lottery. Whether Fulton was an adventurer in this lottery, or purchased of the owner of a prize, we know not. That he did not purchase of the Royal Academy is certain, or at any sale of their pictures. My impression is that he was an adventurer in the lottery, and gained these paintings as a prize. The inaccuracy of one part of Mr. Colden's statement renders further inaccuracy probable.

He endeavored to persuade his countrymen to purchase such pictures of West's as were at the artist's disposal, and he wrote to the citizens of Philadelphia thus:

"I now have the pleasure to offer you a catalogue of the select works of Mr. West, and with it to present you the most extraordinary opportunity that ever was offered to the lovers of science. The catalogue referred to is a list of all Mr. West's productions, portraits excepted. No city ever had such a collection of admired works from the pencil of one man; and that man is your fellow-citizen. The price set on the collec-

tion is fifteen thousand pounds sterling, a sum inconsiderable when compared with the objects in view, and the advantages to be derived from it."

Mr. Fulton was six feet in height, slender in his form, easy and graceful in his deportment. His countenance was animated, and his eyes and forehead betokened genius and unconquerable ardor. He was a kind father, a fast friend, an enlightened philosopher, and a good republican. The arts of America are indebted to him much—but the science and happiness of the world more.

Thus far we have copied Mr. Dunlap's Memoir of Fulton. As there are several claimants for the honor of first introducing steam for navigating purposes, we shall present our readers with extracts from Mr. Bowie's pamphlet advocating Mr. Symington's views, and afterwards insert portions of an article in Chambers' Edinburgh Journal, stating that to Mr. Taylor, the schoolfellow and associate of Mr. Symington, the honor belongs. Mr. Bowie, in reply to the article in Chambers' Journal, says:

A very cursory perusal will show its utter worthlessness, and even to the veriest tyro in mechanics, render its folly and presumption apparent.

The letter and extract, with Mr. Symington's signature appended, can be explained in a manner any thing but creditable to the reputation of Taylor; and the assertion that he superintended the construction of the engine is at variance with the fact admitted, that it was upon the same principle as one for which Mr. Symington had previously procured a patent. Besides, Taylor has still further shown that he was unfit for the office of superintending the construction of the engine alluded to, by the absurd declaration that Mr. Symington in his invention had thrown off the air pump.

Notwithstanding the hollowness of Taylor's pretensions, and notwithstanding Mr. Goulbourn's refusal to allow Mr. Symington's manly petition for parliamentary investigation, as to the justice of his claims, to be presented, the relatives or friends of the former individual,—described as an *amateur* by Captain Basil Hall,—have succeeded, by "*stealthy steps*" and secret influence, in obtaining for his widow a "*surreptitious*" pension from government of fifty pounds per annum. Surely such a glaring act of injustice and misappropriation of the public money deserves the reprobation of every honorable and well constituted mind.

[From Bowie's Narrative.]

William Symington was a native of Leadhills, county of Lanark, Scotland. While receiving an education to qualify him for the Church, an early predilection for mechanical philosophy led him to abandon his theological studies, and pursue with ardor those connected with his favorite science. His genius soon attracted the notice and secured the patronage of Gilbert Meason, Esq. then connected with the Wanlock Head lead mines. Before completing his twenty-first year, Mr. Symington had made several improvements on the steam engine; and, having protected them by His Majesty's Royal Letters Patent, constructed and introduced engines on his principle into different parts of England and Scotland.

As early as the year 1794, amidst the wild bleak scenery of the country he inhabited, and when he knew nothing of any attempts which might have been made to realize such an idea, it occurred to him that steam might be rendered available for the propulsion of locomotive carriages. He immediately set about embodying his idea; and, in 1786, submitted to the inspection of the professors and other scientific gentlemen in Edinburgh, a working model of a steam carriage, which afforded such proofs of capability, that he was warmly urged by all present to carry his invention into full effect.

While the model was in Edinburgh, Patrick Miller, Esq., of Dalswinton, who had heard of it from Mr. James Taylor, *tutor* in his family, who had been a schoolfellow of Mr. Symington, called at Mr. Meason's, and having minutely inspected it, expressed himself highly pleased with the construction and performance. In the course of conversation, Mr. Miller mentioned that he had spent much time in making experiments, for the propelling of vessels upon water by wheels, instead of sails or oars: and that they had been put in motion by applying manual strength to turning a handle or winch. He also said he had attempted to work them by the power of horses; as he had heard something of the same kind had been accomplished, even by means of oxen, in America. It occurred to Mr. Symington, and he stated his opinion to Mr. Miller, that a steam engine might be constructed which would propel a vessel, by communicating a rotatory motion to the paddles by the alternate action of two ratchet wheels, in the same manner as in the model of the steam carriage, then before them. Mr. Miller said he considered such a thing impracticable; and inquired how it would be possible to work such an engine on board, without setting the vessel on fire?

The description given of the model, and the manner in which it was intended to apply the power of steam, seemed to convince Mr. Miller of the practicability of the project: and he observed, that if Mr. Symington thought he could construct a steam engine, and work it with safety on board of a vessel, an experiment should be made, on a small scale, as soon as he, (Mr. Symington,) could possibly attend to it: and it was explicitly understood that the plan and construction of the engine, the mode of producing rotatory motion, and the means to be adopted for guarding against danger, were to be left entirely to Mr. Symington.

Soon after this, he proceeded to construct a small engine on a similar principle to one for which he had previously procured a patent. It was executed under his immediate inspection, and fitted on board a small double keeled vessel, lying upon a lake, near the House of Dalswinton. With this vessel a trial was made of the powers of the invention, in the autumn of 1788, in presence of Mr. Miller, and various persons of respectability; when the boat was propelled in so satisfactory a manner, that it was immediately determined to commence another experiment, upon a more extended scale.

In the month of October, 1789, a second exemplification* was afforded on the Forth and Clyde inland navigation, in presence of hundreds of spectators, who lined the banks of the canal, to witness what seemed so extraordinary an attempt; and who testified by acclamation their satisfaction at its result. Mr. Miller, Messrs. John Adam, of Blairadam, John Balfour, of Pilrig, Ambrose Tibbetts, members of the Carron Company, James Taylor, and David Drysdale, an experienced seaman, who took charge of the helm, were on board. The boat glided along, propelled at the rate of nearly six miles an hour; and all parties interested declared their conviction of the success of the experiment.

After an interval of ten years, the late Thomas Lord Dundas, of Kerse, applied to Mr. Symington, and having alluded to his former experiments, expressed a wish that he would employ himself in constructing a vessel, capable of being propelled by the power of steam, and superseding the use of horses, in dragging vessels upon the Forth and Clyde canal; of which canal his lordship was an extensive proprietor. Accordingly, under the auspices of that intelligent nobleman, a series of experiments was commenced in January, 1801, and continued until April, 1803. The cost of these experiments somewhat exceeded £7,000; but they placed beyond the possibility of doubt the practicability of steam navigation.

Lord Dundas was so convinced of the efficiency of Mr. Symington's exemplification, that he requested a complete model of the steam engine and boat, (with a set of ice breakers attached,) should be made. This was done, and Mr. Symington proceeded to London and presented it to his lordship.

During the time that the boat lay at Bainsford, Henry Bell, of Glasgow, was frequently beheld inspecting it; and, in 1811, he, in conjunction with others, constructed the Comet steamboat, which in that year first plied upon the Clyde.

Much praise has been awarded to Bell for the introduction of steam navigation; but how far he deserves it, the following facts will elucidate: Notwithstanding the many opportunities he had enjoyed,—notwithstanding his having voyaged to America, to instruct, or to be instructed by, the celebrated Fulton,—the Comet was far inferior in her performance, even to Mr. Symington's second exemplification. When the Comet commenced her operations as a passage boat upon the Clyde, she possessed four insignificant paddle-wheels; and took nine hours to sail from Port Glasgow to Glasgow.

* * * * * * *

In concluding this narrative, it is but doing an act of justice, to place on record the principal intelligent and spirited individuals alluded to in the preface.

It has been shown that Mr. Meason proved a warm and zealous patron; that Mr. Miller afforded the means of bringing the invention into notice; and that Lord Dundas perseveringly aided to bring it to the perfection which it attained. But it has not been stated, although deserving of acknowledgment, that his lordship, during the remainder of his life, frequently and generously befriended Mr. Symington.

For Mr. Bruce, the celebrated Abyssinian traveller, Mr. Symington entertained the strongest attachment. Mr. Bruce was so sensible of his worth, that from the time they first became acquainted, until death put an end to their intimacy, they were almost inseparable. And it was supported in the arms of Mr. Symington, that he who had travelled so far, and encountered dangers so many, yielded up his spirit.

To Sir Ronald Ferguson, Sir George Clerk, Prof. Leslie, Messrs. Gilbert Laing Meason, and —— Jardine, engineer, Mr. Symington considered himself under deep

* "These exemplifications exactly resembled each other, in every thing but magnitude."

obligations for the interest they took in his welfare; and to Mr. James Walker he owed the obtaining of a small donation from the London steamboat proprietors. The Messrs. Staintons, of Carron, were also kind and attentive to his interests; and Mr. Robert Wight, accountant, of Edinburgh, rendered him many acts of friendship, and much valuable assistance.

Mr, Symington during life ceased not to remember his benefactors, and it may, with truth, be said, whatever failings he may have possessed, ingratitude was not among the number.

We add the following corroborative testimony, including Judge Clerk's opinion when at the bar:

"Opinion of John Clerk, Esq., advocate, regarding William Symington's specification and patent for steamboats.

"1. I am of opinion there can be no well founded objection to the specification: it describes, in proper terms, the invention for which the patent was granted.

"2. The notice the patentee gives how the same is to be performed is by no means irrelative; but, on the contrary, is requisite and proper.

"3. If the proprietors, or builders of steamboats, refuse a reasonable compensation, the patentee is entitled to stop them by an interdict; but I would not advise that measure. He should rather bring an action of damages against them, for having invaded his privilege, and benefitted themselves by his invention.

(Signed) JOHN CLERK.

"Edinburgh, June 30, 1834."

"It is much to be regretted that there existed not enterprise enough at that time, in Scotland, to encourage the ingenious artisan to repeat his experiments on the Clyde. All the subsequent improvements, however, in steam navigation, may be fairly traced to Mr. Symington's attempt; and we cannot help thinking that he has a strong claim on the national gratitude. He is still alive, and we fear not in the most flourishing circumstances. Should the state decline rewarding such meritorious services, the opulent proprietors of steamboats might well evince their liberality and discernment, by bestowing on him some recompense."—[Article on steam navigation—Supplement to the Encyclopædia Britannica.]

"It is remarkable, also, that the unfortunate Symington, who has such claims to the original invention of the steamboat, had previously contrived a similar application for the propelling of carriages; and actually exhibited, in the year 1787,* in the house of Mr. Gilbert Meason, in Edinburgh, the first model of a steam carriage that was, perhaps, ever seen."—[Article on locomotive carriages—Quar. Rev., March, 1830, page 380.]

"Mr. Symington took out a patent for steamboats in the year 1801; and he has the undoubted merit of being the first person who applied the power of the steam engine to produce motion in vessels."—[Capt. Basil Hall's Travels in North America, Vol. 2, page 387.]

"The earliest successful application of steam appears to have been made on the Forth and Clyde inland navigation by Mr. Symington."—[E. Galloway on the Steam Engine.]

"Several attempts have been made to apply the force of steam to the purpose of propelling boats in canals; and there seems to be no reason to think the undertaking by any means liable to insuperable difficulties. Mr. Symington appears to have had considerable success; and the method that he has employed for making a communication between the piston and the water wheel is attended with many advantages."—[Journal of the Royal Institution of Great Britain, Vol. 1, 1802, p. 195.]

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[From Chambers' Edinburgh Journal.]

The credit of the inestimable invention of applying steam to the purposes of navigation has now been claimed by so many pretenders, that we believe the public are at this moment as much puzzled to whom to assign the palm as they have all along been to penetrate the mystery of the authorship of Junius. Independent of the numerous claimants in our own country, our brethren on the other side of the Atlantic have not been slow to assert their title: but although it be true that the great and important results likely to accrue from the discovery were first fairly developed on the Hudson, we are perfectly prepared to show, that *there* certainly the idea did not originate; that it was altogether of British, or rather of Scottish origin; and from documents now in our possession, we have little doubt of being able to set this disputed question for ever at rest, to the satisfaction of the public, and to prove that to the individual whose name stands at the head of this memoir, the world is indebted for all the benefits they enjoy by means of that wonderful fabric, the Steamboat.

* And in 1786.

In 1787, Mr. Miller engaged in a sailing match with a party of gentlemen at Leith, in his double vessel, against a first-rate sailing wherry. Mr. Taylor was, of course, on board; and to this circumstance may be attributed the primary projection of applying the steam-engine to navigation. Mr. Miller's vessel won the day, and Mr. Taylor felt perfectly convinced of the efficiency of the *principle* by which it was wrought; but, having taken a spell at the wheels, he found the labor so excessive, that he told Mr. Miller, that, unless he could apply a more commanding power than that of men, the invention would be of little use. Mr. Miller acknowledged the justice of the observation, and requested the aid of his cogitations on the subject, adding, that the only other plan he himself could think of was the employment of the capstan. Mr. Taylor's thoughts forthwith became steadfastly directed to the subject; and after much reflection, and many conversations with his employer, he at last suggested the steam-engine. Mr. Miller started many objections on the score of the danger of fire, &c.; but at last, after great persuasion, and not until Mr. Taylor had demonstrated by drawings the practicability of connecting the engine with the wheels, he agreed to have a small engine built, and to give the plan a trial. Accordingly, on the family coming into Edinburgh for the winter, from Dalswinton, Mr. Taylor was requested to find out a proper engineer for the purpose; and a young acquaintance of his, named William Symington, employed at the lead mines at Wanlockhead, Dumfrieshire, and who had invented a new construction of the steam-engine, (by throwing off the air pump,) being at the time in Edinburgh for his education, he recommended and introduced him to Mr. Miller. It was then agreed that the experiment should be made on the lake at Dalswinton, in the ensuing summer, (1788.)* In the autumn, Symington was sent for to Dalswinton to put the parts together, and fit the engine upon the vessel, a handsome double pleasure-boat. The experiment which followed succeeded perfectly; the vessel moving at the rate of five miles an hour, notwithstanding the smallness of the cylinders, which were only five inches in diameter. This trial took place in presence of hundreds of people, and an account of it, drawn up by Mr. Taylor, was inserted in the Dumfries Journal the same month, (Oct.) It was also noticed in the Scots' Magazine of the following November.

In 1801 or 1802, Mr. Symington, who, up to this time, had never laid the shadow of a claim to Mr. Taylor's invention, induced Lord Dundas to employ him to fit up a vessel for the Forth and Clyde Canal Company. This was accordingly done, but when set a-working, the agitation of the water and consequent washing of the banks, which it caused, was so alarming, that the Company would not permit it to be used again, and it was laid up at Lock Sixteen. It happened that, at this period, Mr. Fulton, the American engineer, was travelling in Britain for information in the line of his profession, and, whilst visiting the Carron works, in company with Mr. Henry Bell, then a carpenter at Glasgow, first heard of the steamboat. He forthwith applied to Mr. Symington, who resided in Falkirk, for leave to inspect the boat, which was immediately complied with, and every information readily furnished. The consequence was, that both Mr. Fulton and Mr. Bell immediately conceived the project of separately turning the invention to their own account. Mr. Fulton launched his first boat on the Hudson in 1807, and he and his country claimed the merit of the invention. Mr. Bell was somewhat tardier in his movements, and it was not until 1812 that his first steam-vessel, the Comet, was set a-going on the Clyde—when he, like Mr. Fulton, also claimed the merit of the invention. In the mean time it appears that Mr. Symington, too, not only laid pretensions to it, but had secretly taken out a patent so far back as the year 1802 or 1803. This stealthy step, however, of which neither Mr. Taylor nor Mr. Miller had the slightest suspicion, serving him nothing: for when he raised an action of damages upon it in 1815, against the proprietors of the Clyde steamboats, they defended themselves successfully on the plea that he was not the original inventor. Mr. Symington's unfair and continued interference, and the discovery of the surreptitious patent, of which Mr. Taylor was not made aware, until long afterwards, and not until many years after Mr. Miller's death, seem to have called forth an indignant remonstrance from Mr. Taylor, as we find by a letter of Mr. Symington, dated February, 1821, evidently intended to soothe his irritation, and promising to pay him one-half of the interest and proceeds of the patent.

Very shortly after Mr. Taylor's decease, application was made to the government, by one of his relatives, on behalf of his widow and family, in which some pretensions, brought forward at the time by Mr. Symington, in a letter to the editor of the Edinburgh Evening Courant, were most satisfac-

* Referred to at page 164, vol. iv.

torily refuted. In this communication to government, also, a letter was quoted, penned so far back as the year 1787, by Mr. Symington to Mr. Taylor, in which that gentleman so explicitly acknowledges the originality of the conception of the applicability of the steam engine to the purposes of navigation, as belonging to the subject of this memoir, that it seems altogether incomprehensible how he could ever afterwards presume to attempt the appropriation of it to himself. An extract from this letter of Mr. Symington, as well as of his promissory epistle to Mr. Taylor, of February, 1821, is subjoined; and it is thought proper here to state, that the originals of these, as well as of many other communications between the parties on the same subject, have been submitted to the inspection of one of the editors of this publication. Mr. Symington subsequently attempted to renew his pretensions in a communication to the editor of the Ayr Advertiser; but these were so thoroughly set at rest by a respondent in the same publication, that it is unnecessary here to allude to them more particularly.

"I must make some remarks on your summer's invention, which, if made to perform what its author gives it out for, will undoubtedly be one of the greatest wonders hitherto presented to the world, besides being of considerable emolument to the projector. Great success to you, although overturning my schemes; but take care we do not come upon your back, and run away with them by some improvement. Your brother John gives a kind of credit to your report, which, for some reasons, I did not discourage. I must conclude, &c. &c.

(Signed) WM. SYMINGTON."

"Sir,—In terms of our former agreement, when making experiments of sailing by the steam engine, I hereby bind and oblige myself to convey to you, by a regular assignation, the one-half of the interest and proceeds of the patent taken by me upon that invention, when an opportunity occurs of executing the deed, and when required. I am, Sir, your obedient servant, (Signed) WM. SYMINGTON.

"To Mr. James Taylor, Cumnock."

For further information respecting Mr. Taylor's claims to be the inventor, see page 164, vol. iv., of the Mechanics' Magazine.

NOTT'S PATENT BAKERS.—We have examined this new invention for the kitchen, and cannot but conclude that it will answer a valuable purpose. It consists of a tin box, nearly three feet long, about 18 inches deep and wide, in the centre, and gradually diminishing in width towards each end, which is circular. Within about two inches of each end is a furnace, consisting of a sheet iron tube, four inches in diameter, similar to stove pipe, passing perpendicularly through the box, with a grate at the bottom, and a pan to receive the ashes, and a damper at the top to regulate the draught and heat. Large wire rods are passed horizontally through the box, on which materials for baking are placed, and fires made in the furnaces with charcoal. The heat from the iron tubes is reflected by the inner surface of the box, and the process of baking goes on with great uniformity and rapidity. Persons in this village, who have tested this Baker thoroughly, say that two quarts of coal will bake twelve pounds of meat and a peck of potatoes; and that one dollar's worth of common charcoal *is* sufficient to bake all the provisions of an ordinary family for a year. A great saving of firewood and expense is clearly exhibited by this fact. The Baker is portable, weighing but a few pounds, and can be put in the most convenient place for use. They are manufactured by Messrs. P. &. H. Hatch, of this village, who have the exclusive right of making and vending them in this and Orange county; and are sold for $5. In the summer season, especially, this Baker must be a valuable article for every housekeeper, and ensure a great saving of labor and fuel.—[Vermont Courier.]

EXTRAORDINARY IMPROVEMENTS IN INDIAN RUBBER.—The singular properties of Caoutchouc, or Indian Rubber, which some few years since was used only for the insignificant purpose of rubbing out the pencil marks upon paper, is now being introduced into numerous varieties of articles of dress, &c. Experiments are now going on by order of the Admiralty on board his Majesty's ship Excellent, at Portsmouth, upon guns, breachings, &c., (which are quite satisfactory,) their elastic quality saving the jerk of the recoil of the gun. The experiments have been made, and are continuing with 68-pounder long guns, and 32-pounder carronades. For stoppers for cables, and preventing the dragging of the anchor, or the breaking of the cable and hawser ropes, it will be invaluable. For the invention, we are indebted to Mr. Seivier, whose various scientific acquirements are well known and appreciated. The importation of Caoutchouc now amounts to some hundred tons annually, and so great is the demand for that article, that some of the West India planters are planting their estates with the tree, (Havea guianensis,) which is a species of fig, in order that they may be prepared to meet the increased demand. The tree being carefully cultivated, of course will much improve the quality of the Caoutchouc. The manner in which the patent elastic rope is manufactured is by cutting the India rubber into long strands, and placing them strand and strand with the hemp yarn; they are thus twisted together: when finished, by the application of heat the caoutchouc collapses, and, by that means, the rope is rendered elastic.—[English paper.]

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